Rubén González, PMM Transmission GIS Switzerland, Perú 23.04.2015

Gas Insulated Switchgear (GIS)

Visión tecnológica hacia soluciones GIS

Power and productivity
for a better world™

Transmission GIS – Jornadas Técnicas
Contenido

- GIS Alrededor del mundo
- GIS Descripción general y beneficios
  - Aplicaciones y ejemplos
- Diseño modular - Configuraciones
- Tópicos técnicos específicos de la GIS
  - Transferencia de barra
  - Compartimentación de gas
  - Operaciones en campo y pruebas AT
- GIS Portafolio de productos

ABB Primera GIS del mundo
UW Sempersteig 170kV GIS (1967)

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Mercado total estimado 2014 por región

	Bahías	Precio MUSD
2013	13’067	3’465
2014	13’943	3’623

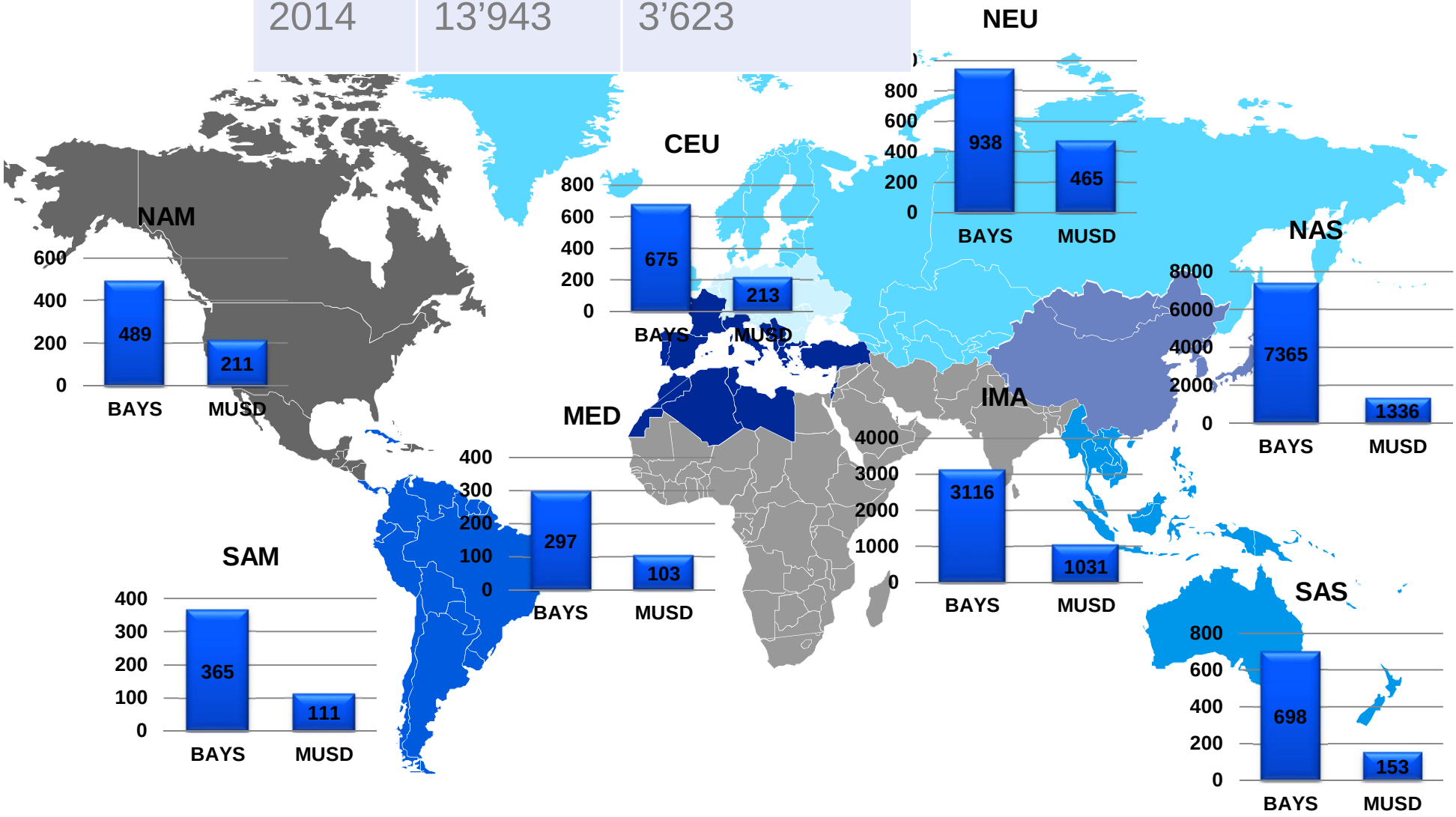

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ABB red de fábricas
Ubicaciones

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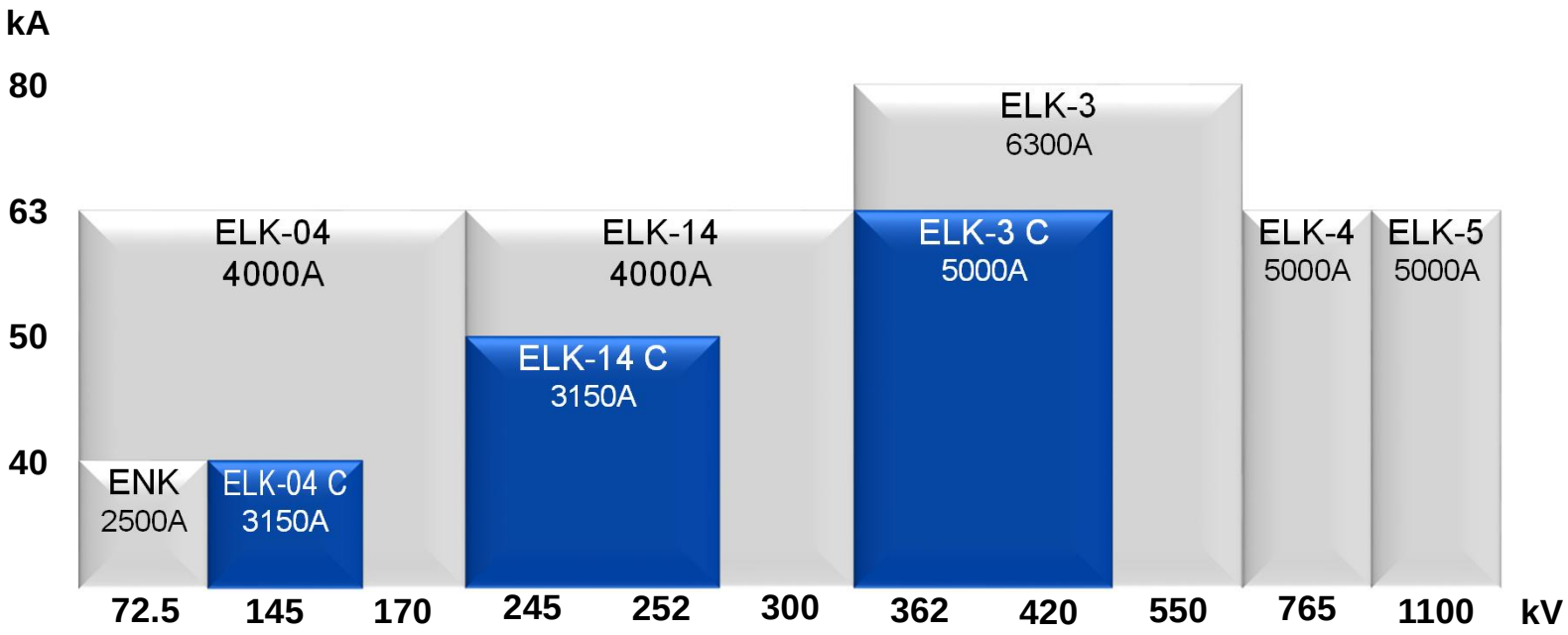
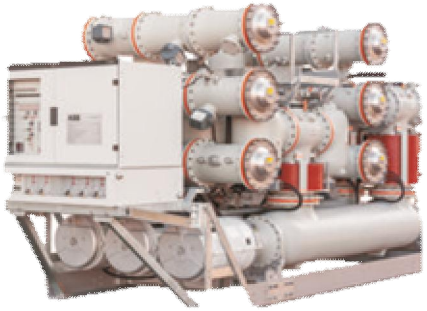
ABB GIS portafolio de productos
Visión general





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Gas Insulated Switchgear (GIS)

GIS Descripción general y beneficios

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GIS - Gas Insulated Switchgear
Descripción general

Precio

LTB
- Interruptor

DTB
- Interruptor
- Transf. de conrriente

Mód. híbridos
- Interruptor
- Transformador Corriente
- Transformador Tensión
- Seccionador
- Puesta a tierra

GIS
- Interruptor
- Transformador Corriente
- Transformador Tensión
- Seccionador
- Puesta a tierra
- Barras / GIBs

Integración de Funciones

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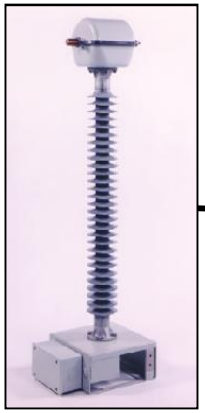
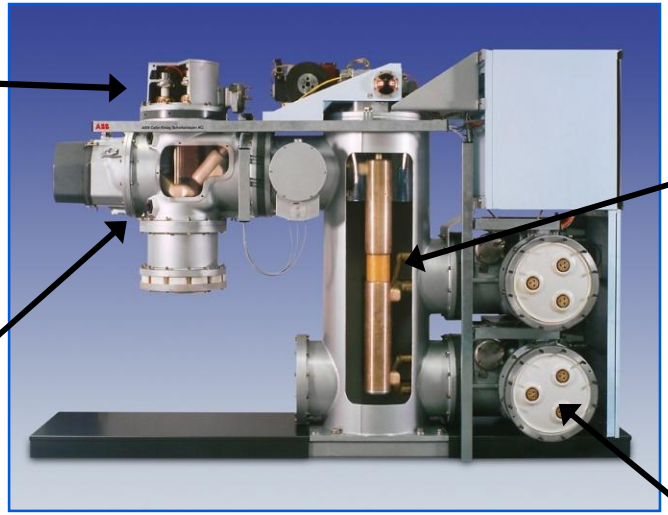
ABB – GIS de alta tensión
Integración de funciones



▪Transformadores de medida

GIS



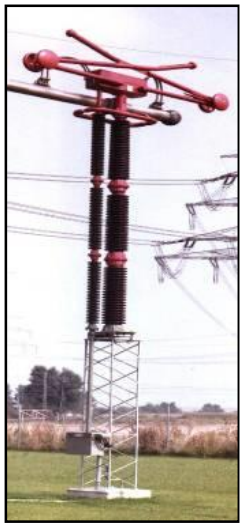
▪Interruptor

▪Seccionadores

- Estructura Soporte
- Aisladores
- Cubículo de control
- Cableado de control
- Supervisión
- Pruebas en campo

▪Barras

ELK-14, 245 - 362 kV
Sección transversal configuración doble barra



Earthing switch

Disconnector

Current transformer

Fast-acting earthing switch

Voltage transformer

Cable termination

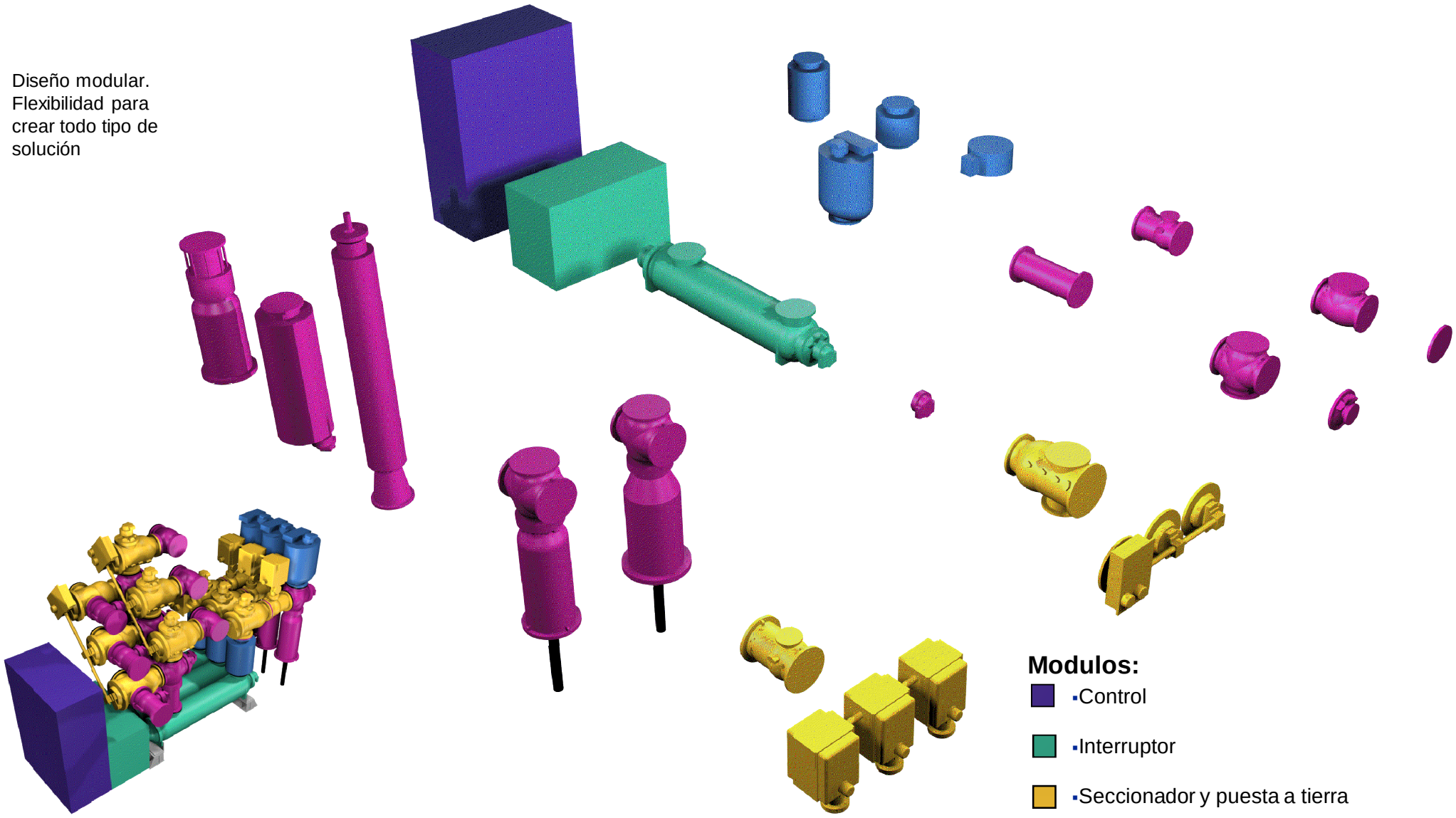
Local control cubicle

Drive

Circuit-breaker

ELK-14, 245 - 362 kV
Diseño Modular

Diseño modular. Flexibilidad para crear todo tipo de solución



Modulos:

- Control
- Interruptor
- Seccionador y puesta a tierra
- Transformadores de medida
- Elementos de conexicón

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Gas Insulated Switchgear (GIS)

Configuraciones

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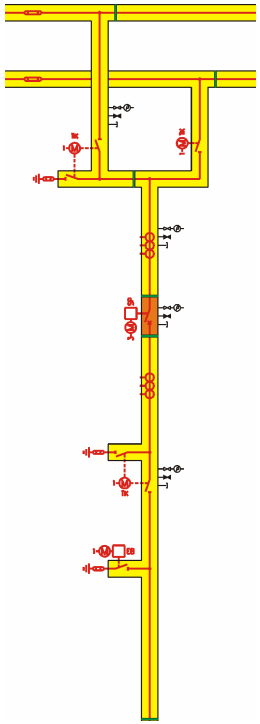
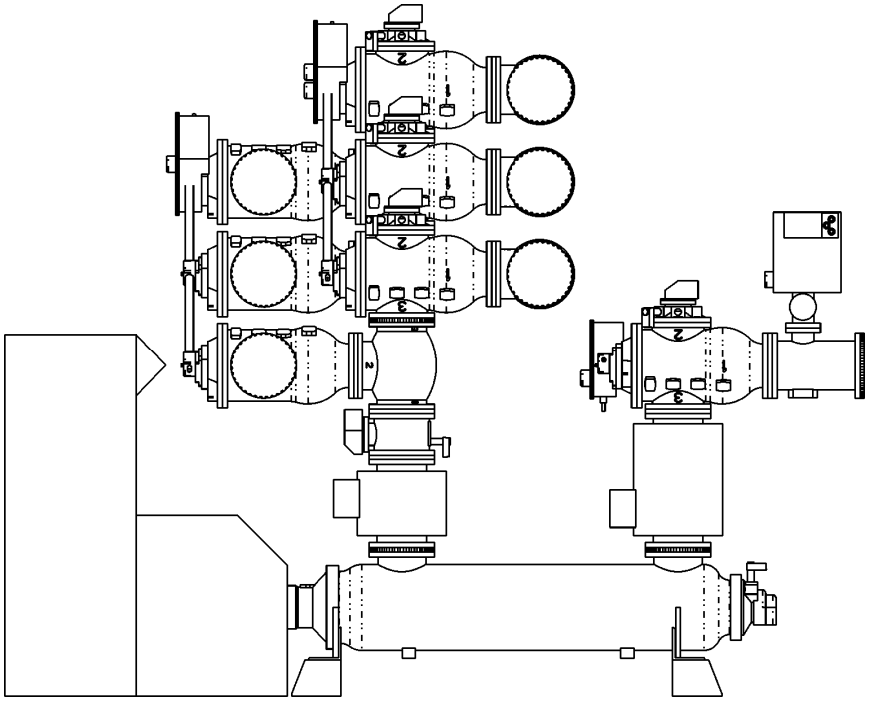
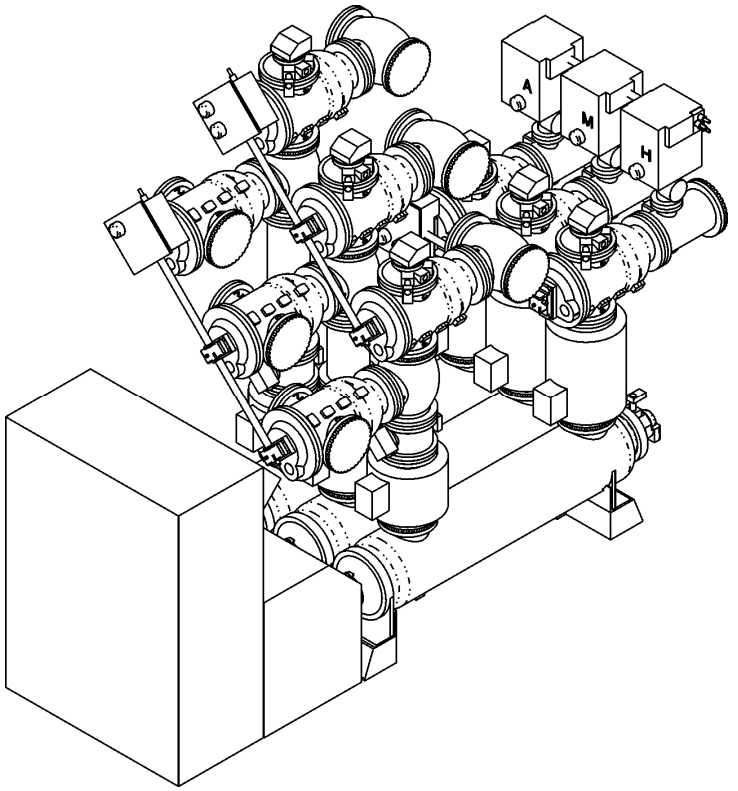
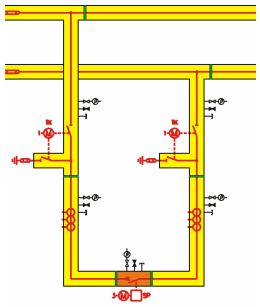
ELK-14, 245 - 300 kV
Arreglo doble barra

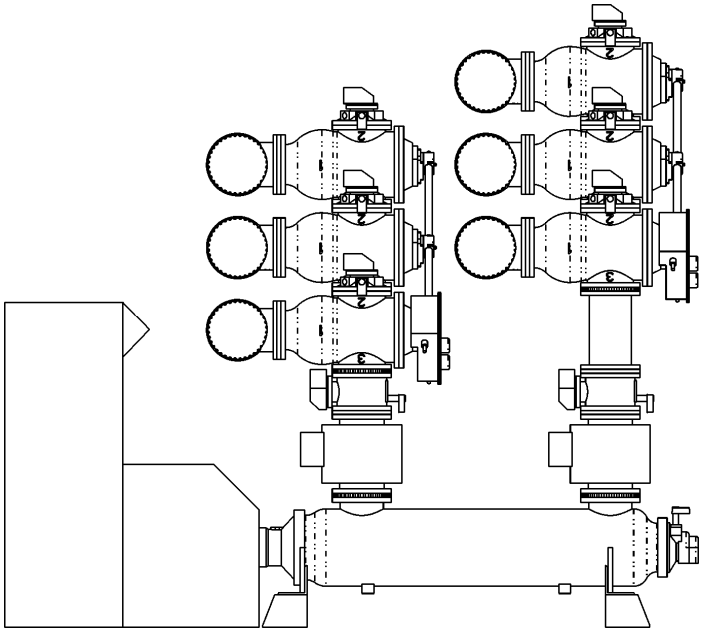


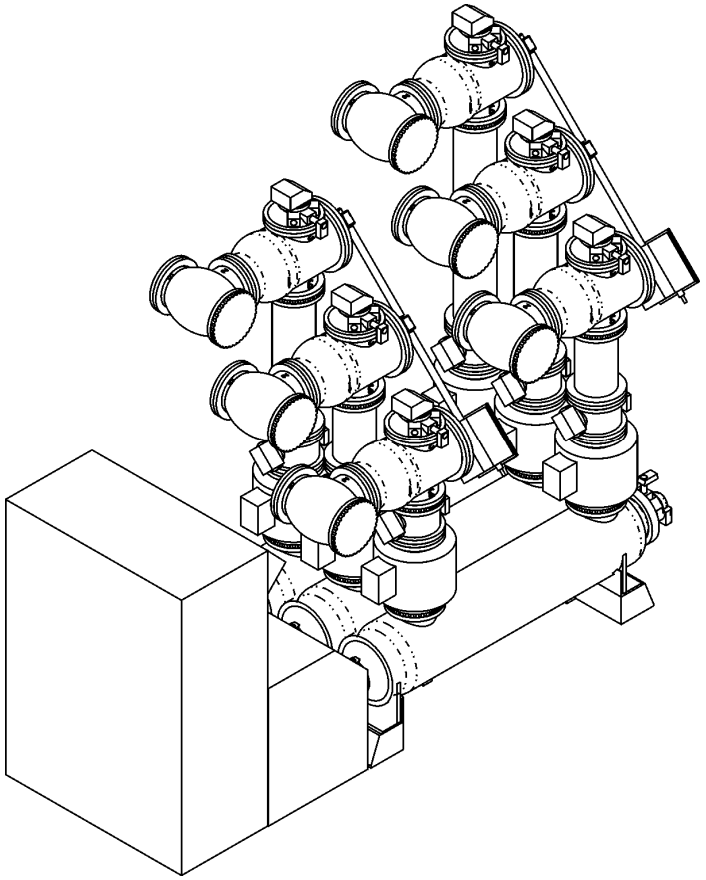




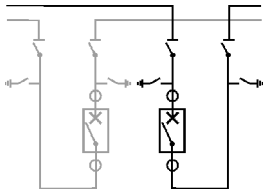
ELK-14, 245 - 300 kV
Acoplador – Arreglo doble barra

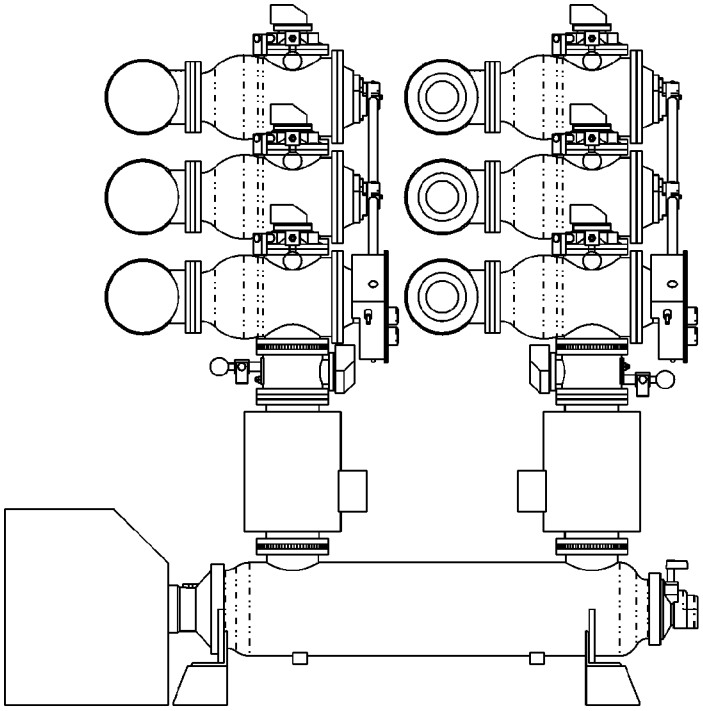


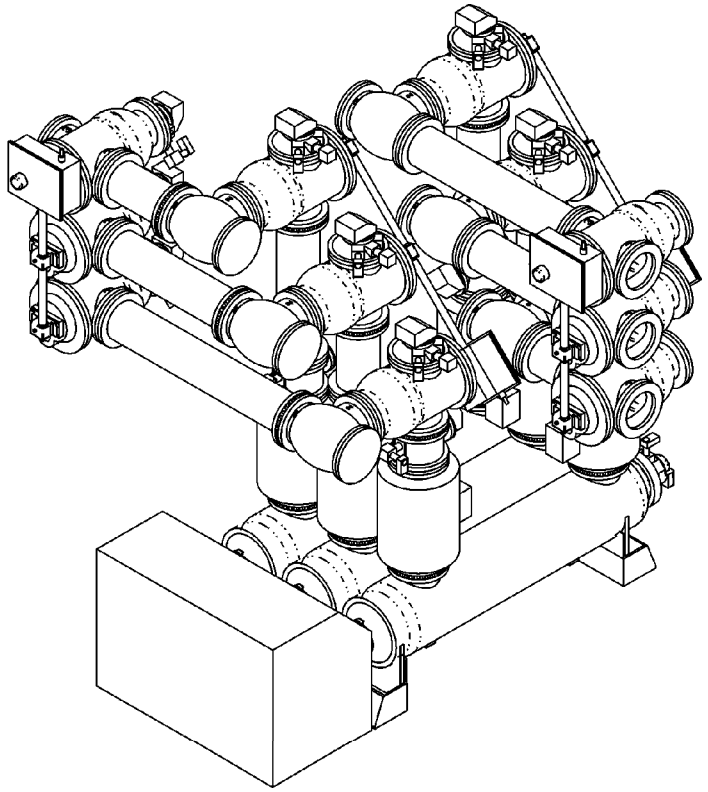




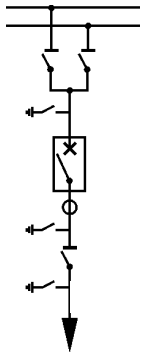
ELK-14, 245 - 300 kV
Bahía seccionadora – Arreglo doble barra

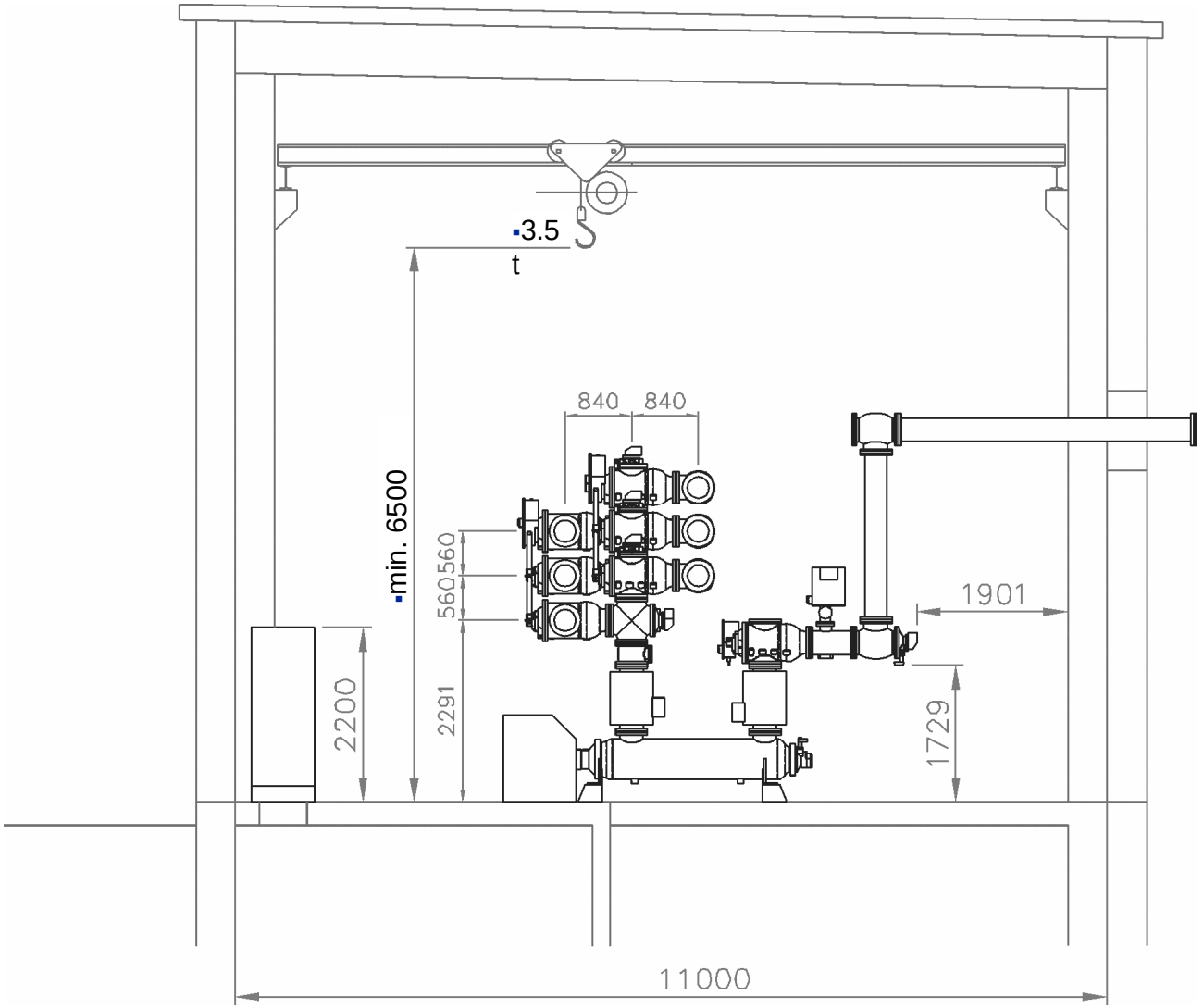




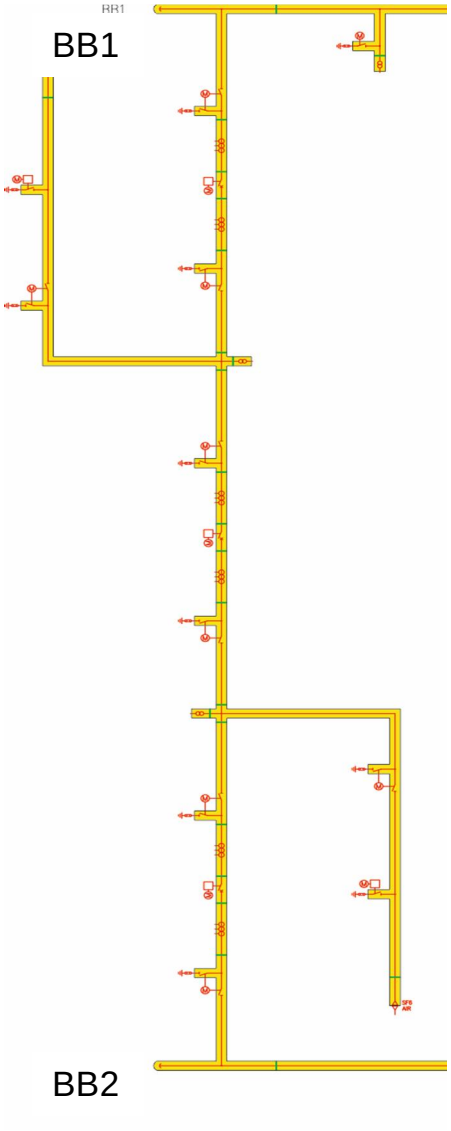


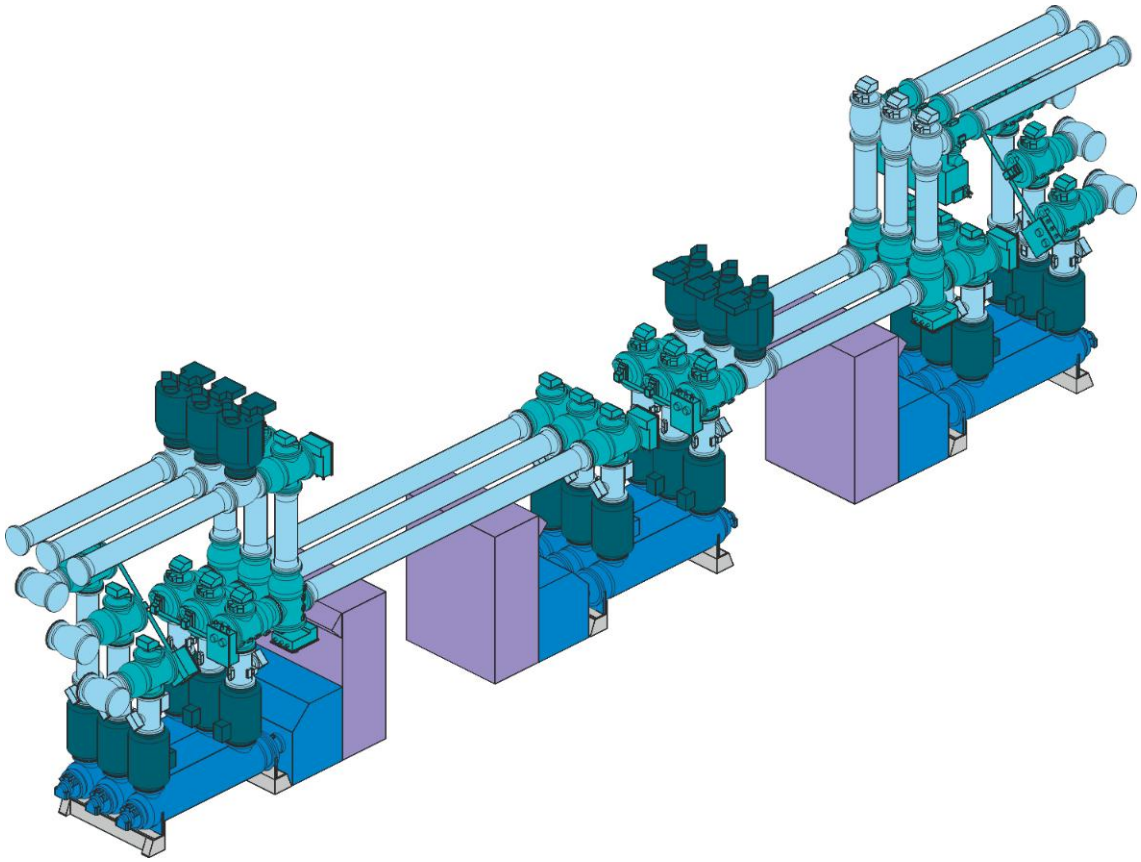
ELK-14, 245 - 300 kV
Dimensiones – Arreglo Doble Bara





ELK-14, 245 - 300 kV
Interruptor y medio, configuración en línea





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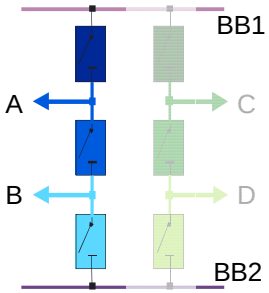
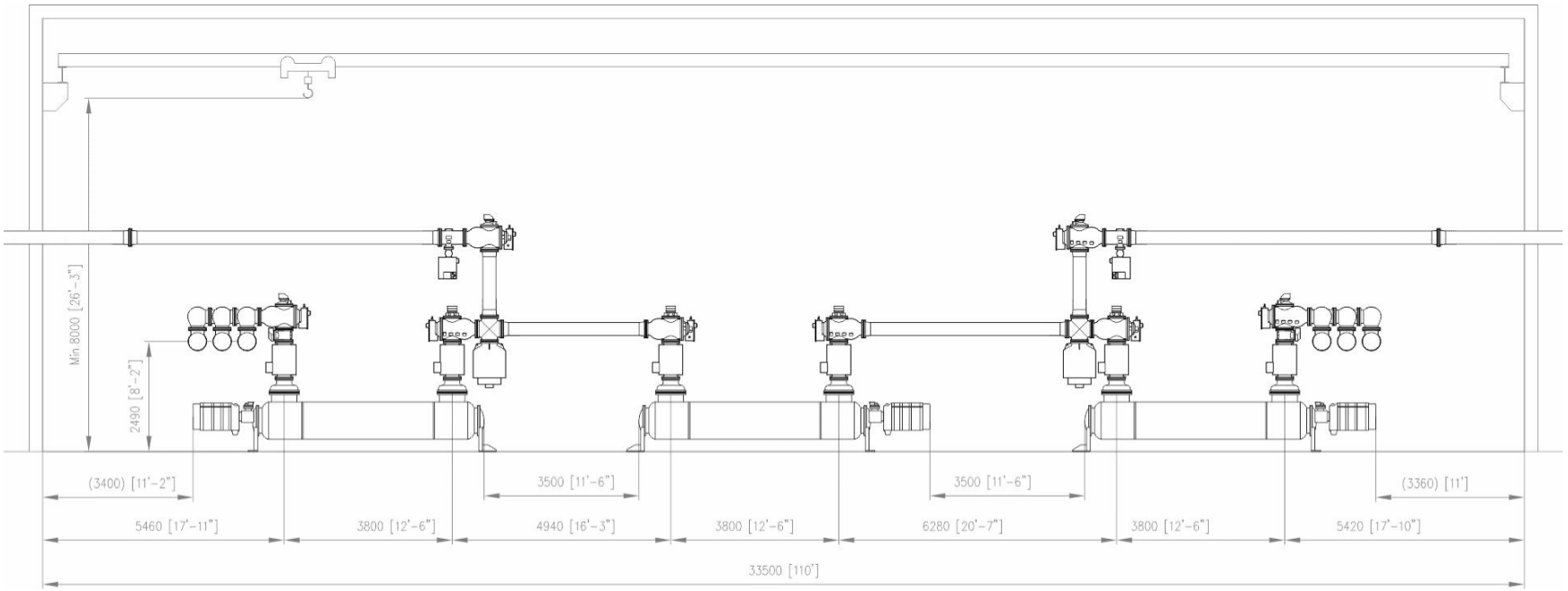
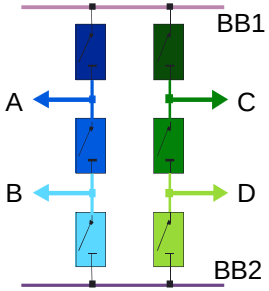
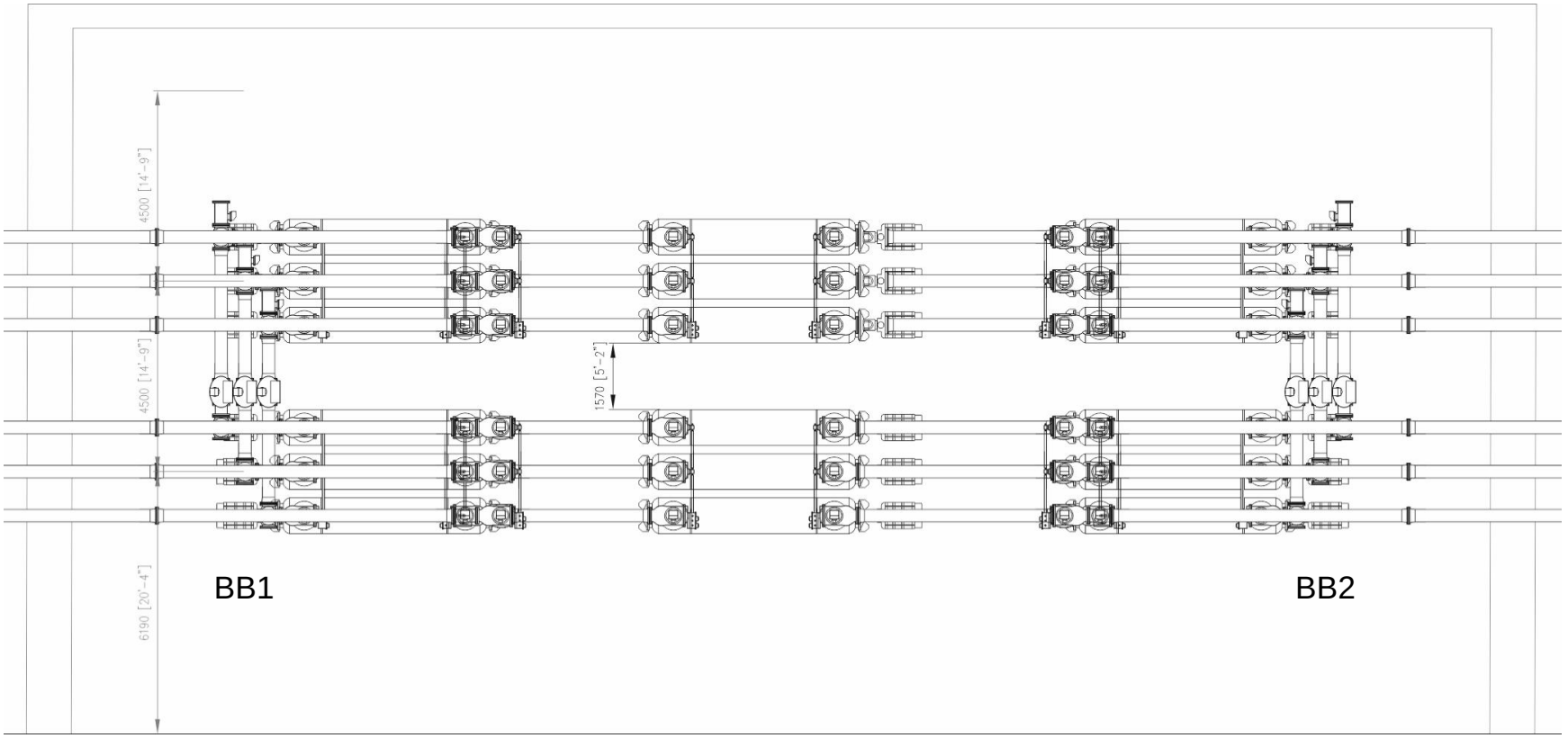
ELK-14, 362 kV / 80 kA
Interruptor y medio, configuración en línea





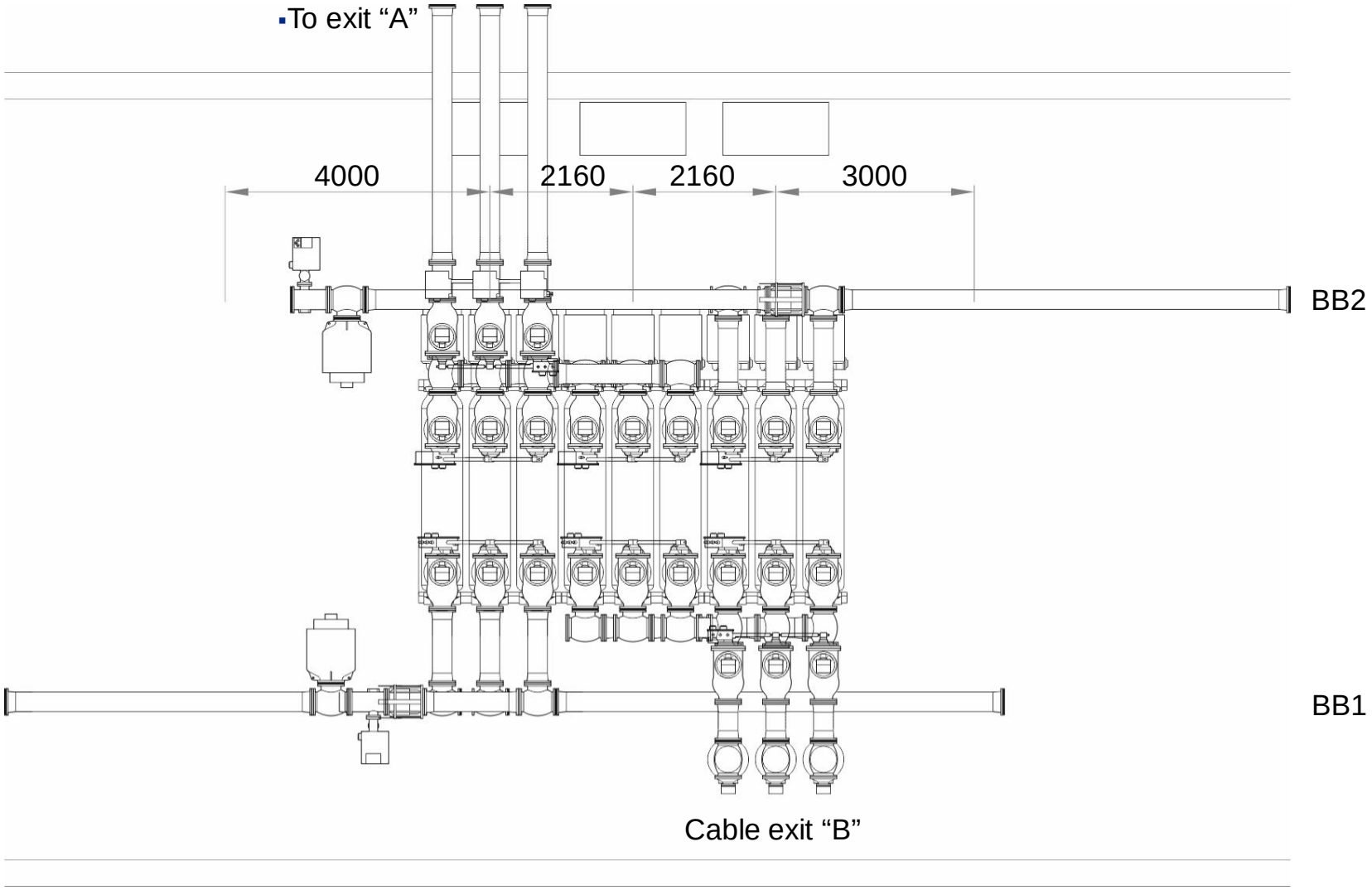
ELK-14, 362 kV / 80 kA
Interruptor y medio, configuración en línea



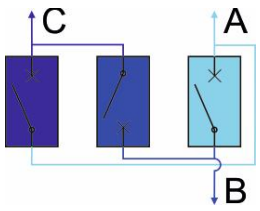


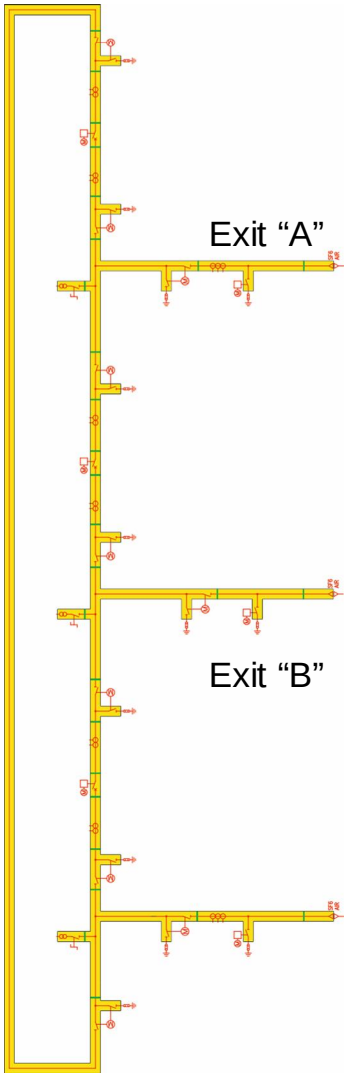
ELK-14, 362 kV / 63 kA
Interruptor y medio, configuración side-by-side

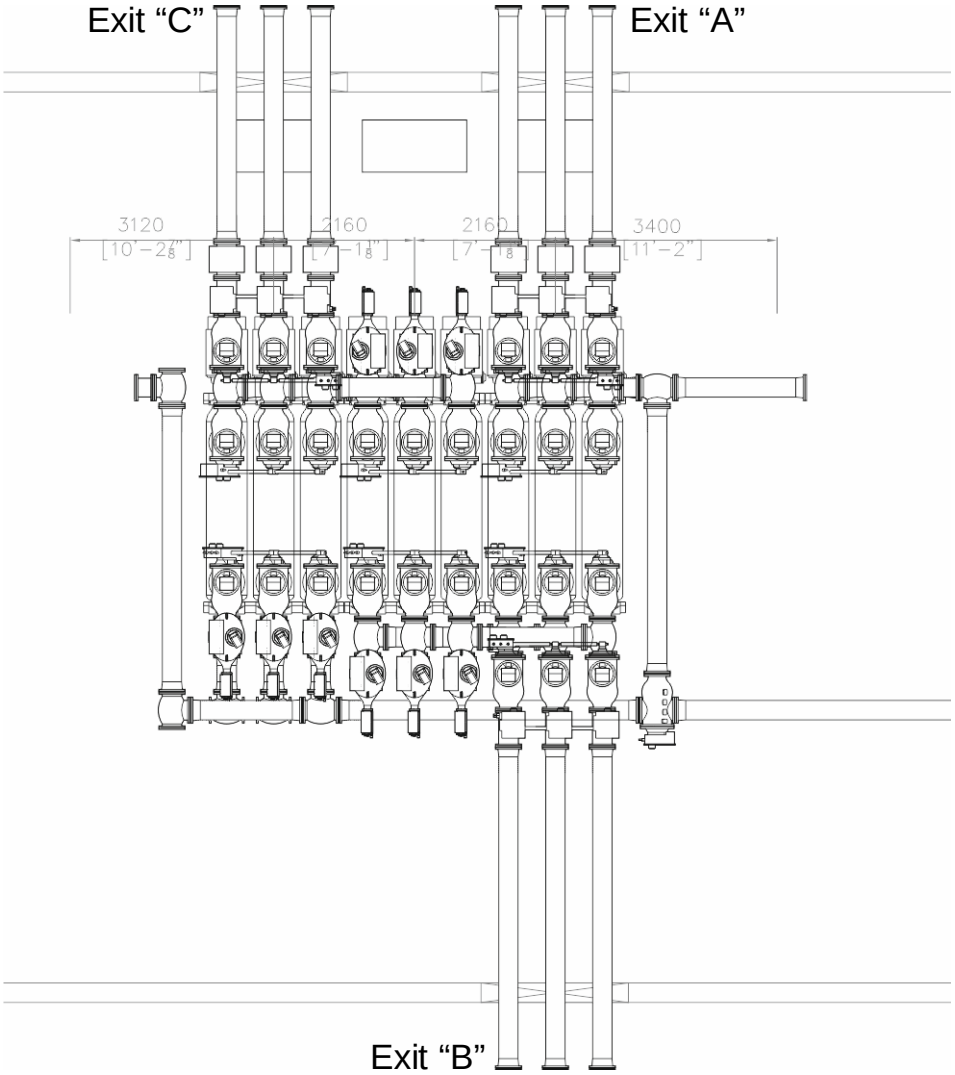
1 diámetro



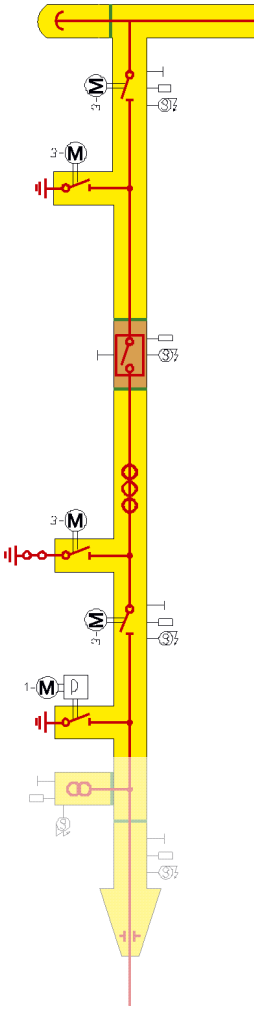
ELK-14, 362 kV / 63 kA
Arreglo en anillo

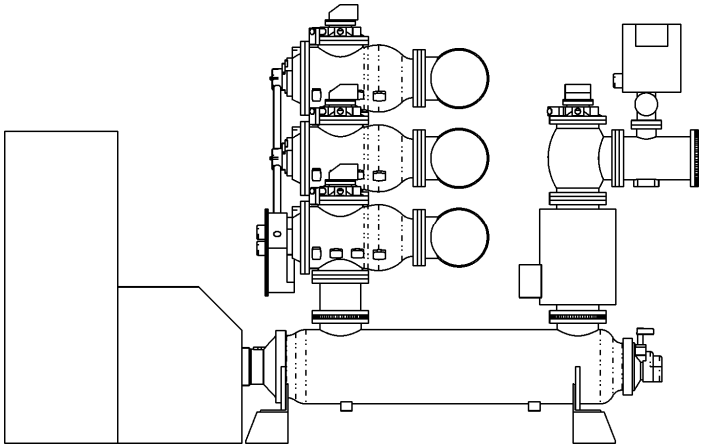


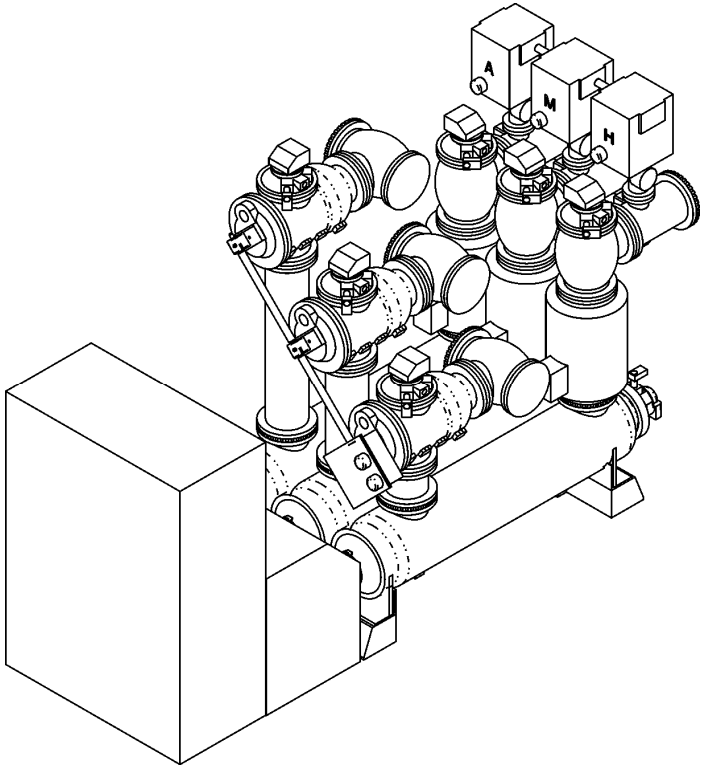




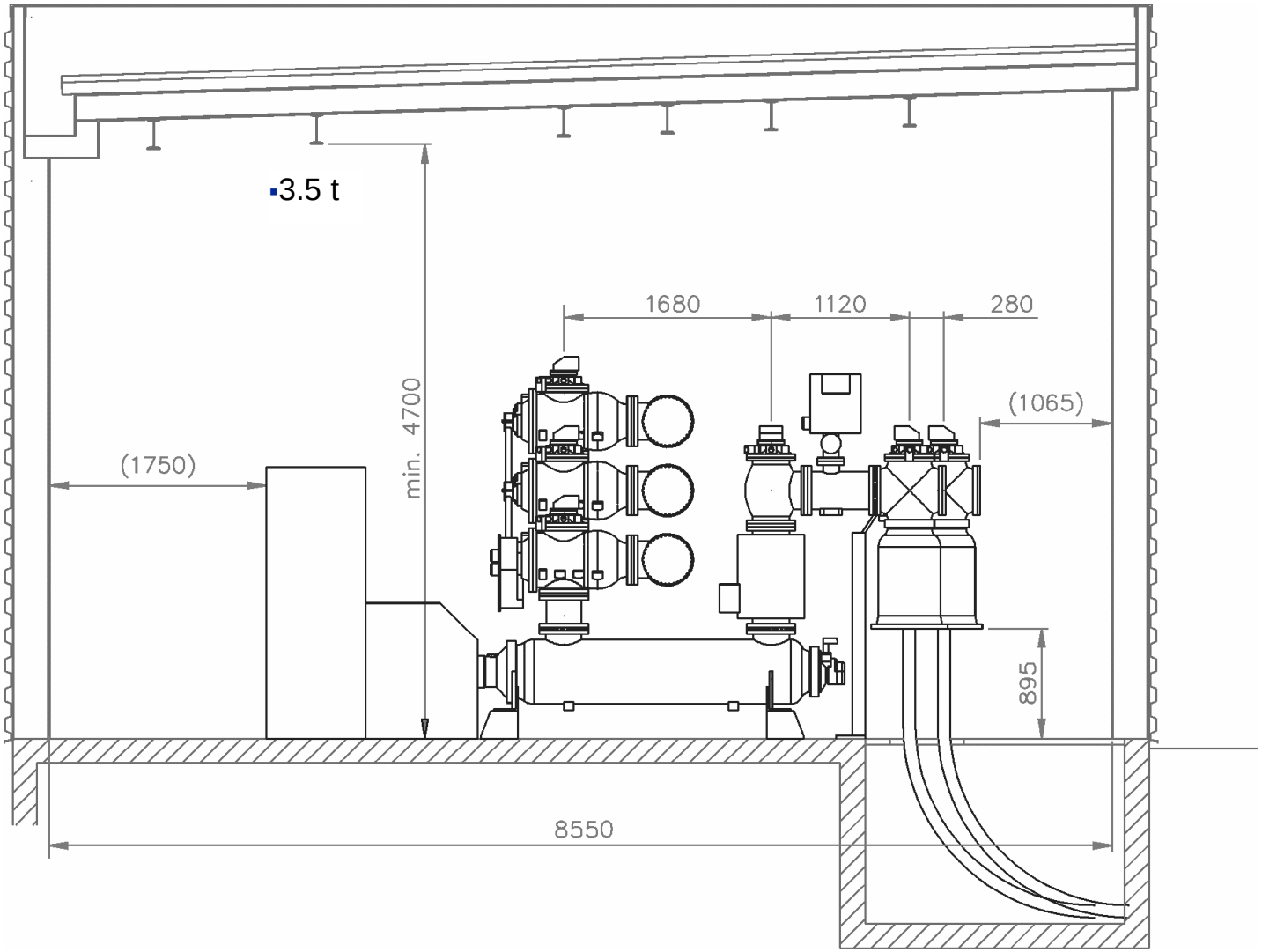
ELK-14, 245 - 300 kV
Barra simpla – bahía sin salida







ELK-14, 245 - 300 kV
Dimensiones – arreglo barra simple



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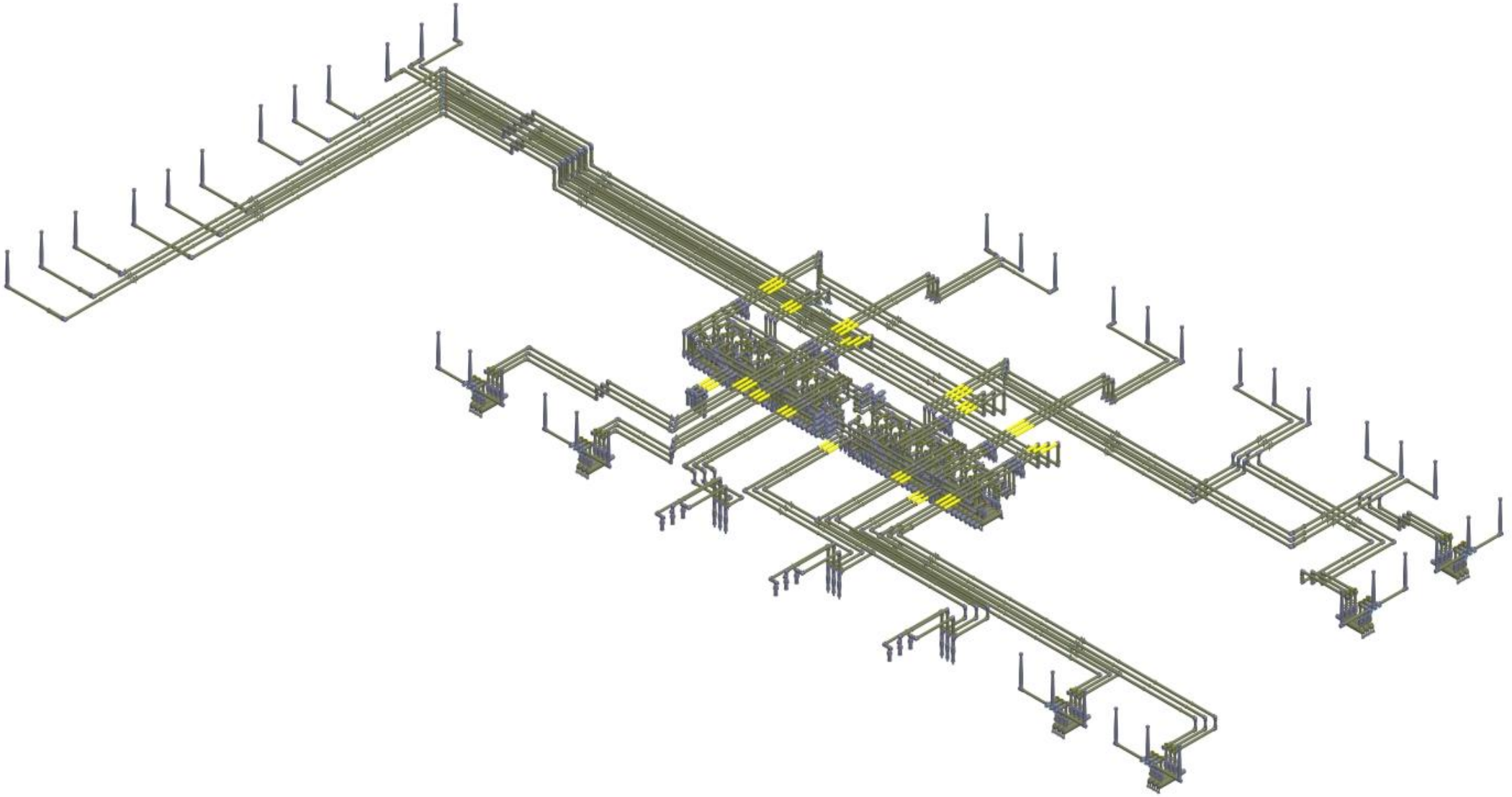
Madain (Saudi Arabia) – 380kV - 2012
Ejemplo – 1 ½ CB – Salidas dobles - Reactor



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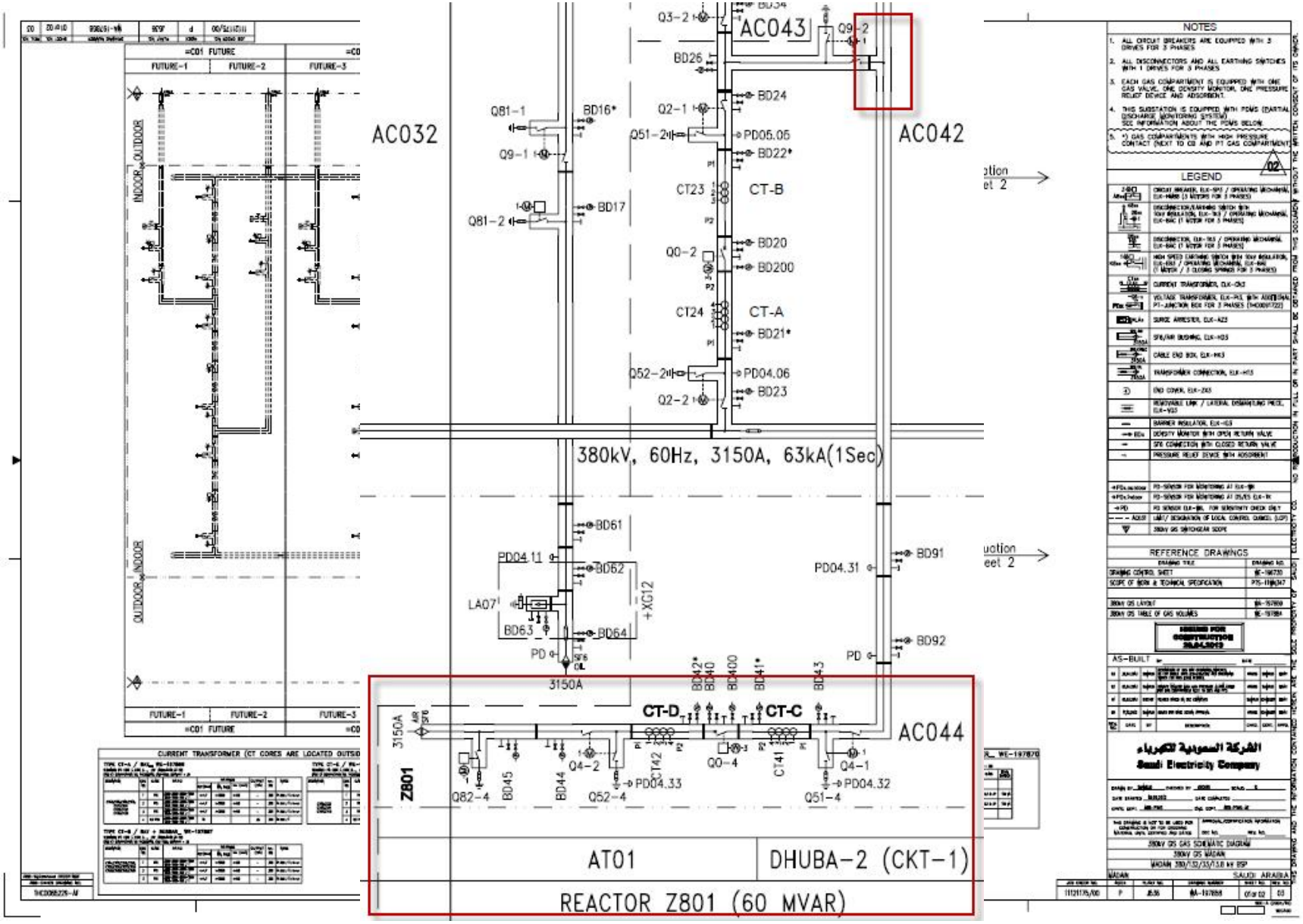
Madain (Saudi Arabia) – 380kV - 2012
Ejemplo – 1 ½ CB – Salidas dobles - Reactor



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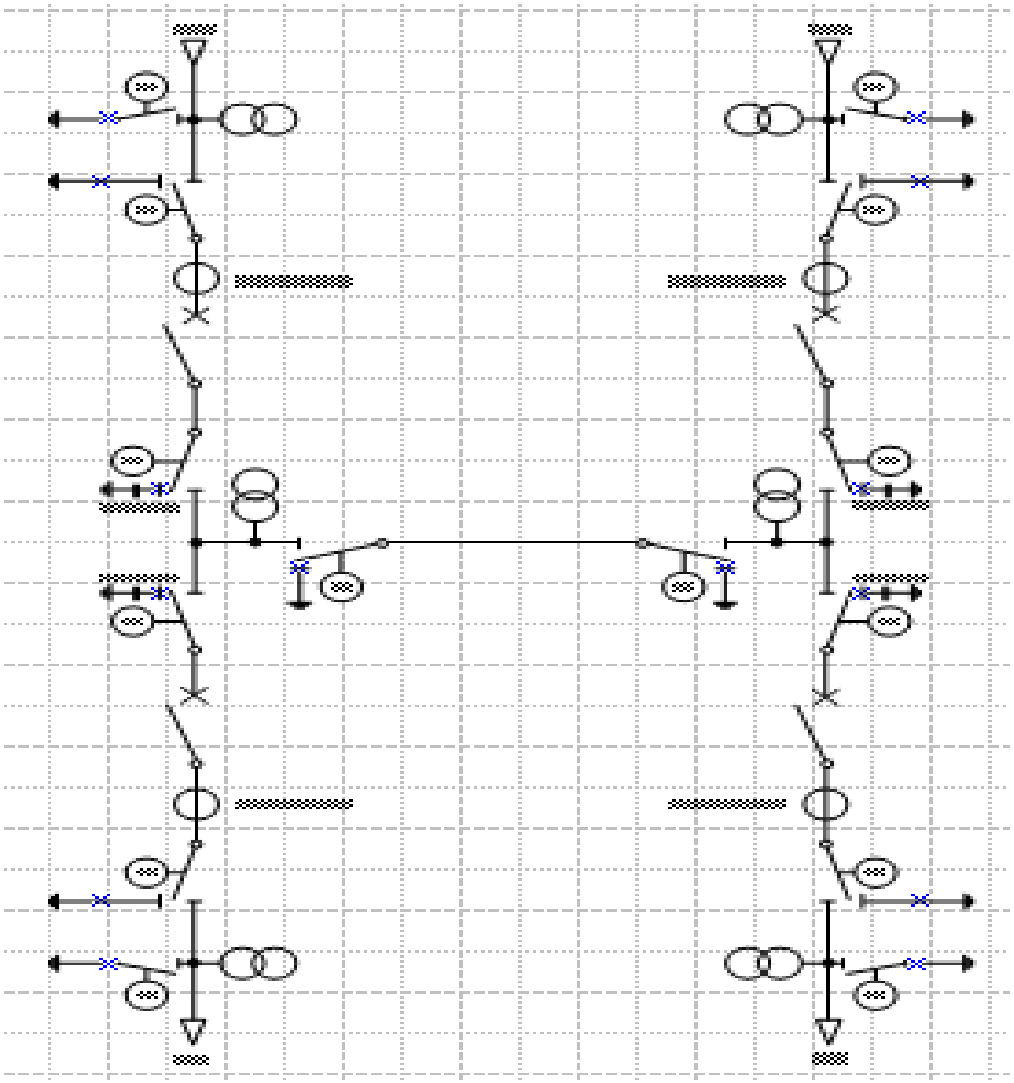
Del unifilar a la configuration (1)
Cómo se vería este unifilar?



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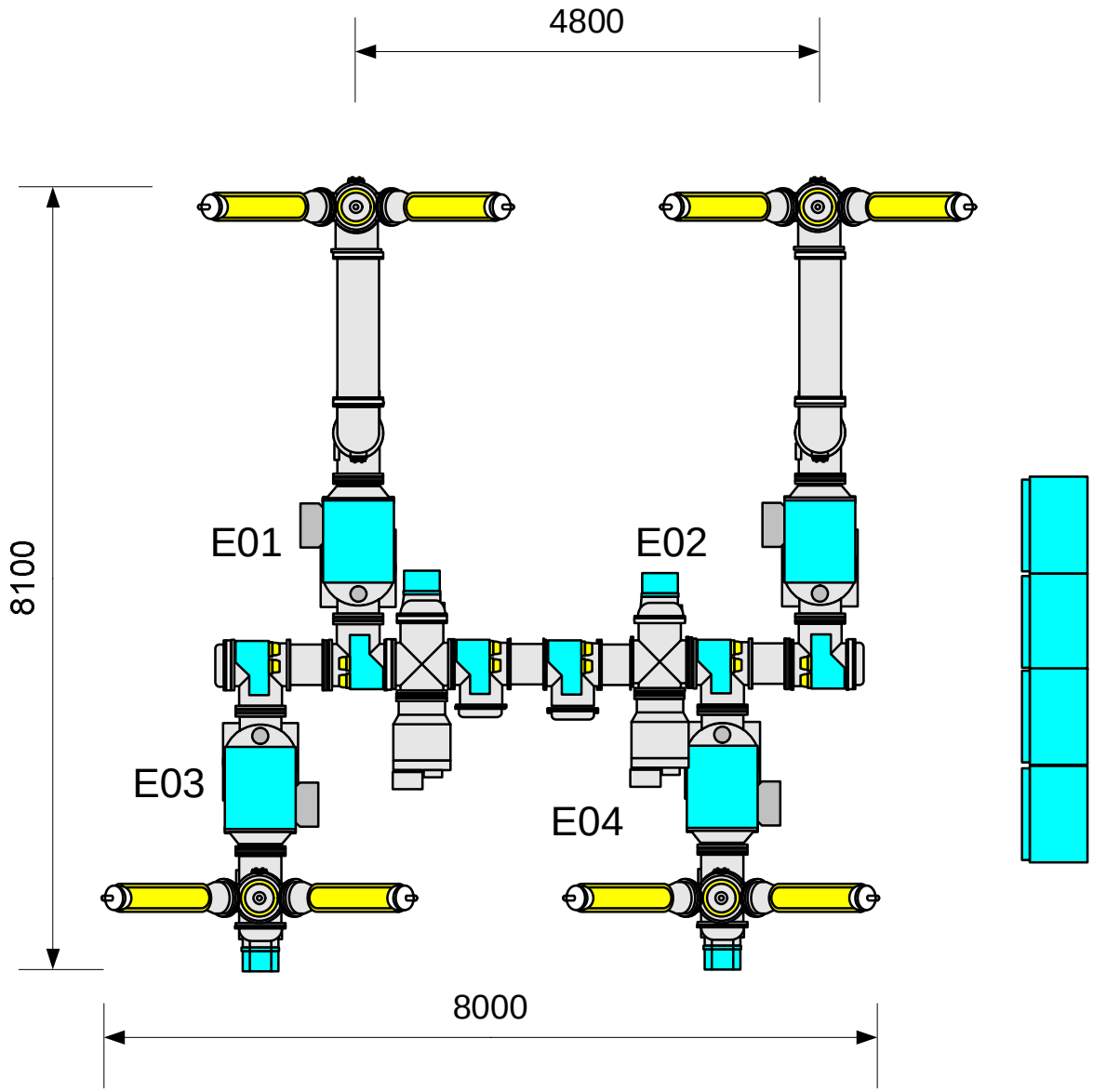
Del unifilar a la configuration(2)
Así?



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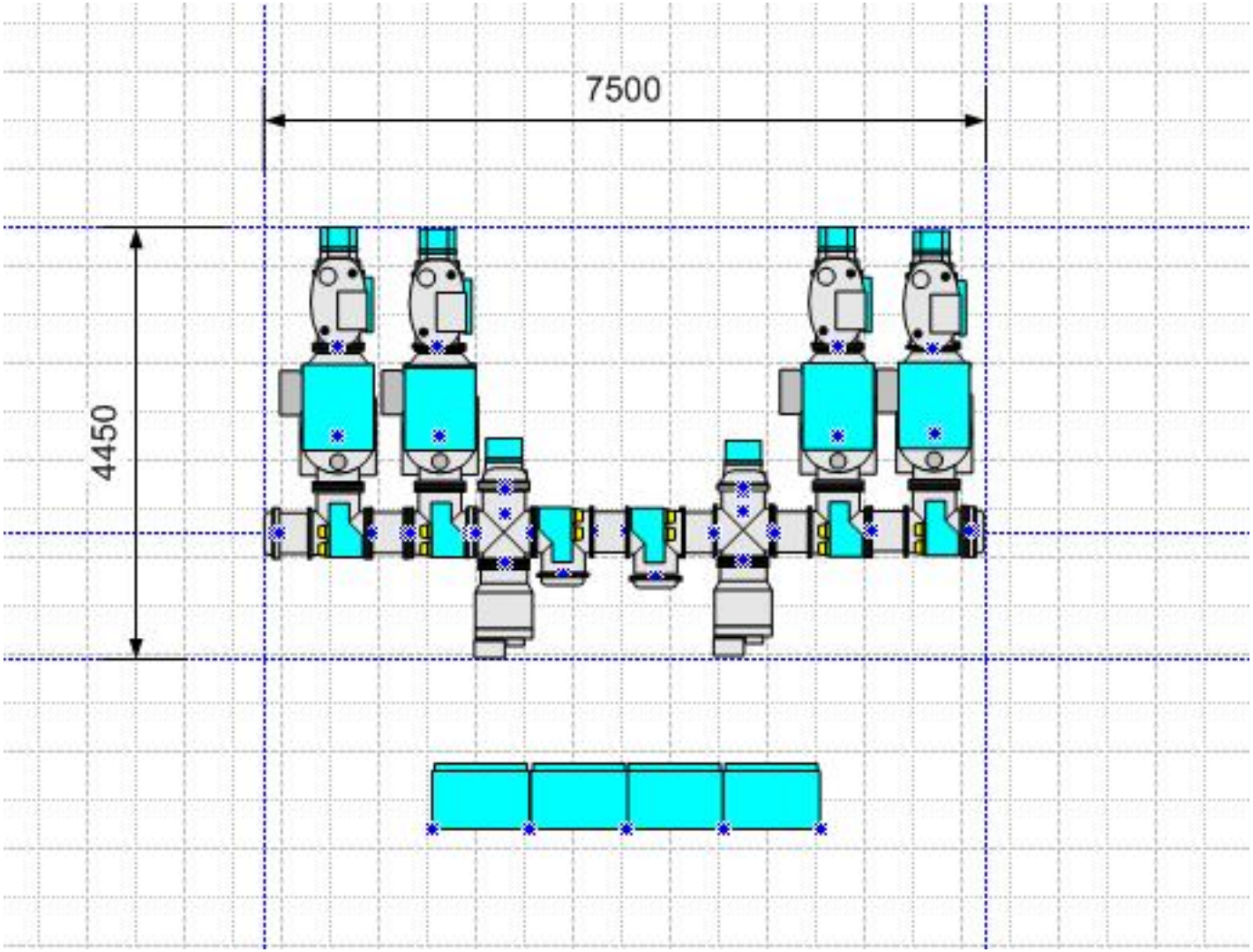
Del unifilar a la configuration (3)
… o así?



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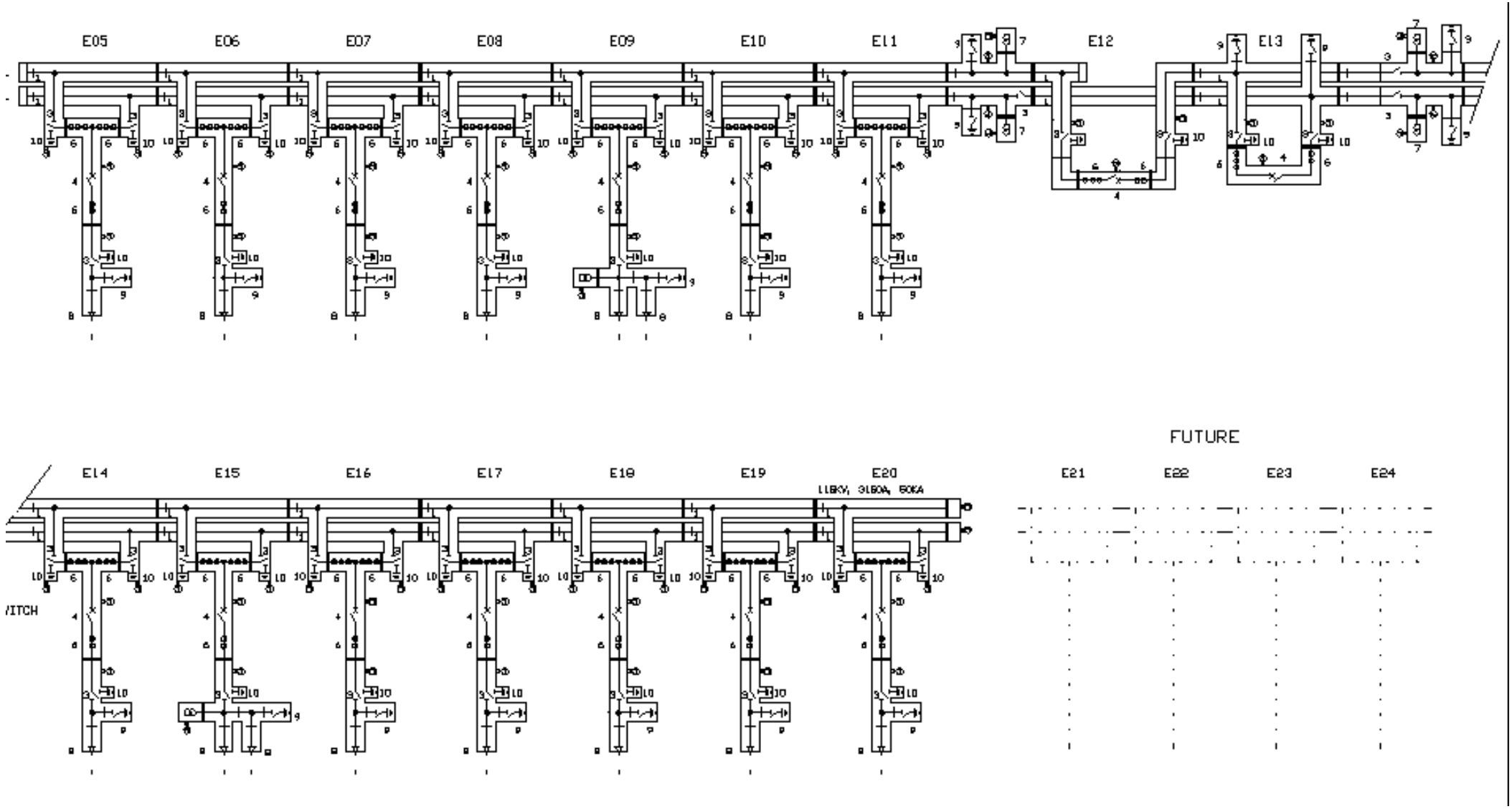
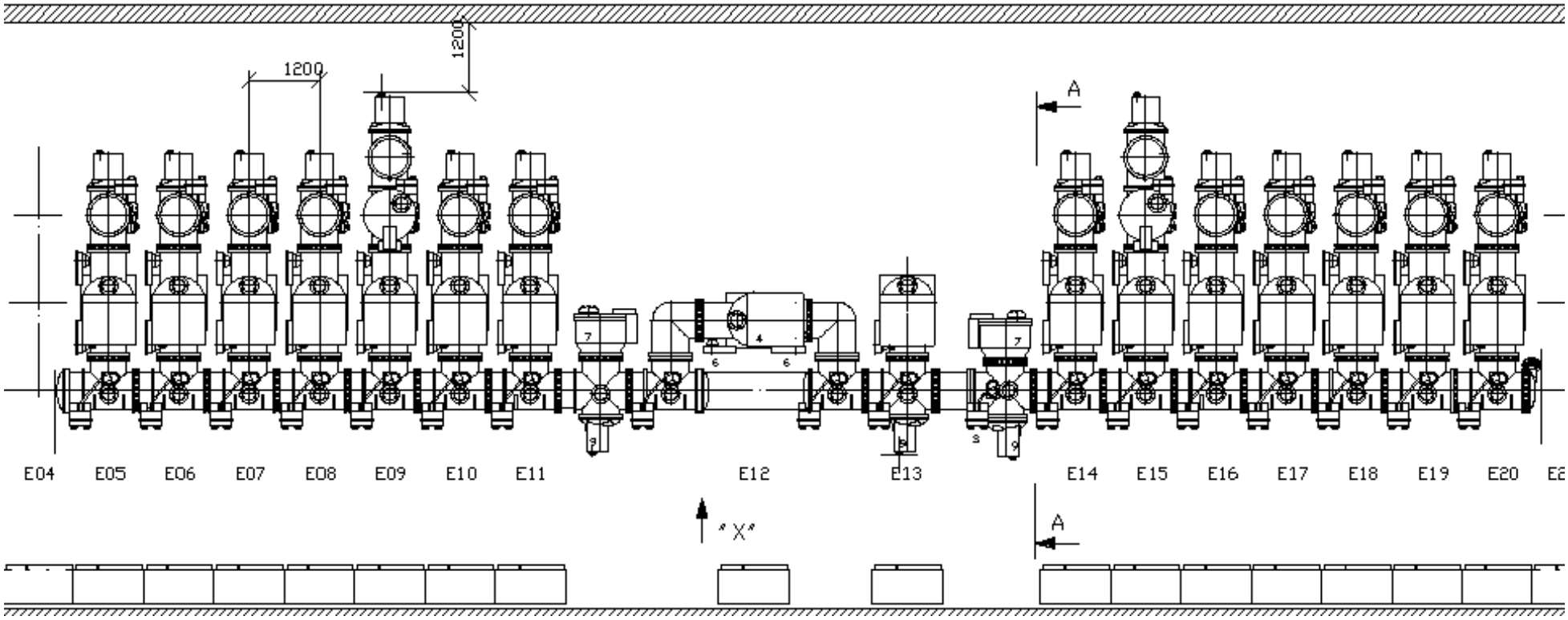
Del unifilar a la configuration (4)
otro ejemplo: cómo se verá el „layout“?



Del unifilar a la configuration (5)
así?



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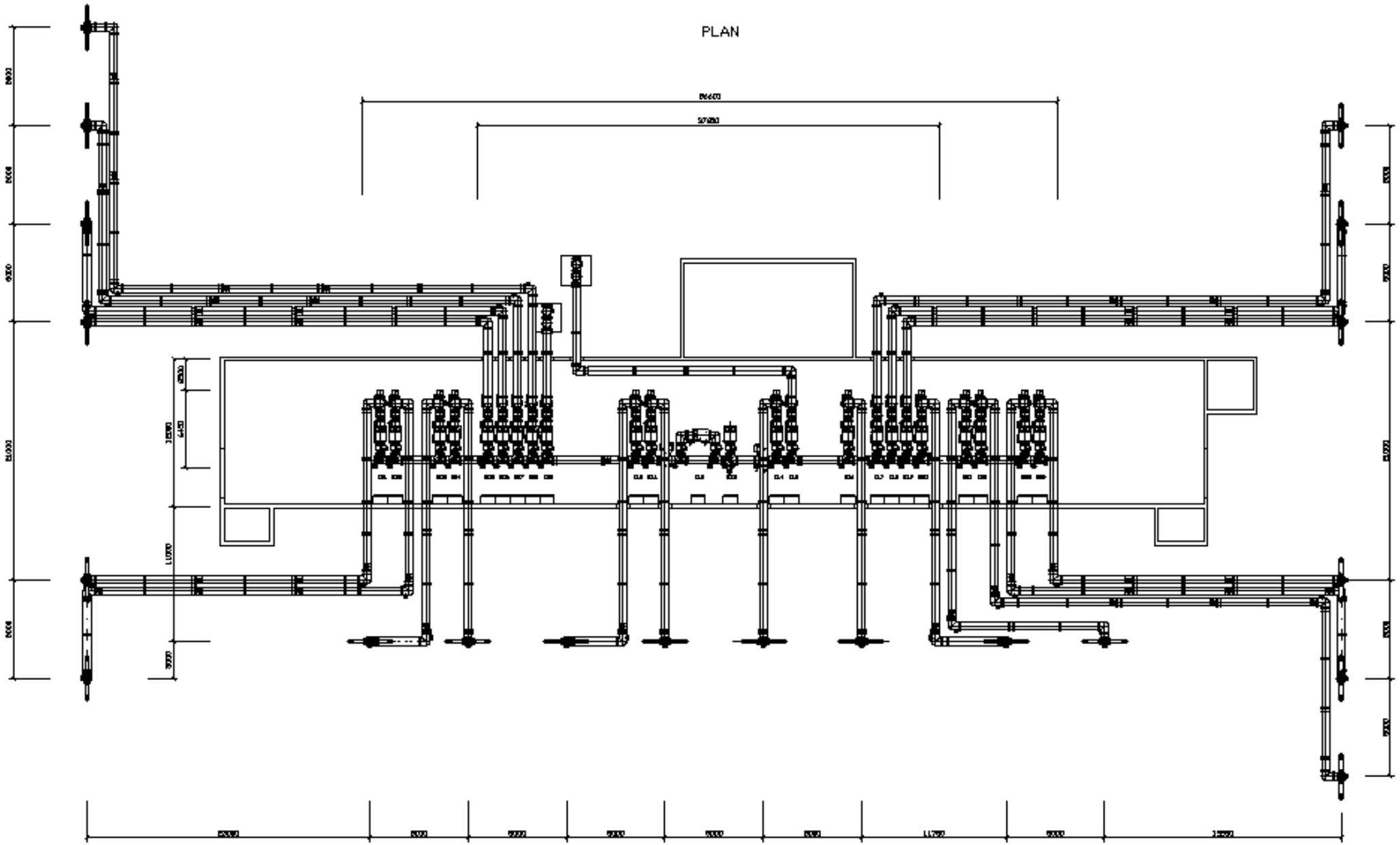
Del unifilar a la configuration (6)

…o así?



GIS Gas Insulated Switchgear
Beneficios

- Resistencia a las influencias ambientales
- Bajo impacto ambiental
- Apropiada para áreas sísmicas
- Apropiada para grandes altitudes
- Alta fiabilidad
- Bajos costos en el ciclo de vida
- Bajo requerimiento de espacio
- Flexibilidad en el diseño del proyecto

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Beneficios de la GIS
Condiciones Ambientales

Completamente encapsulada

Influencias Ambientales

- Inmune a:
  - Polución (agua, sal, arena, suciedad)
  - Rayos
  - Animales

- Capaz de soportar:
  - Temperaturas: + 55°C / - 55°C
  - Clase de polución: IV
  - Humedad: 100%

Sus beneficios

- Bajos niveles de mantenimiento

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Ejemplo – Reducción del Impacto Ambiental
Subestación Barbaña 145 kV (Spain)

Impacto Ambiental

Caso

- Fuertes quejas por
  - Niveles de ruido
  - Consumo de energía (aire acondicionado, refrigeración)
  - Ecología (impresión visual)

Solución ABB

- Subestación llave en mano 145kV
- Transformadores enfriados por agua
- Reducción del ruido por la cascada

Sus beneficios

- Incremento en fiabilidad de la red
- Solución ecológica
- Apreciación ecológica del parque

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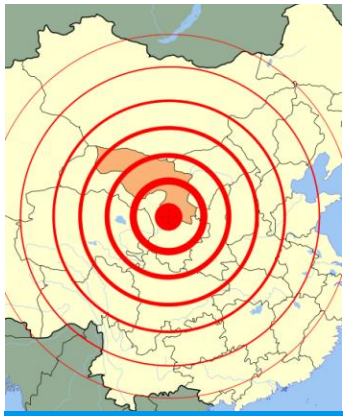
Beneficios de la GIS
Regiones sísmicas

Req. Sísmico

Subestación Convencional



Magnitud de 7.9

SE Maoxian después del terremoto

- Bajo centro de gravedad de la GIS de ABB
- Fiable contra terremotos

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Beneficios de las GIS
Centros Urbanos

Subestaciónes compactas

Espacio

Características:

- Poco espacio - caras zonas urbanas
- Instalación cerca de cetros urbanos
- Altos niveles de tensión al centro de la ciudad
- Estética
- Vandalismo

Sus beneficios

- Mayor aceptación
- Menores pérdidas en la línea
- Seguridad

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Ejemplo – Optimización del Espacio
Subestación Copacabana (Brazil)

Light S.A.

Año de puesta en servicio: 2005

Espacio

Caso

- Substitución (2) SE AIS en zona muy cara

Solución ABB

- 138/13.8 kV GIS con 7 bays HV GIS bays and 62 MV GIS bays
- Optimización del espacio
- Sistema GIS sin mantenimiento

Sus beneficios adicionales

- Incremento fiabilidad de la red
- Ingresos adicionales por venta de propiedad

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Ejemplo – Optimización del Espacio
Simbach (Alemania) – 400kV - 2012
Actualización SE … pero desde 220kV a 400kV

Espacio

© ABB Group

Ejemplo – Optimización del Espacio
Simbach (Alemania) – de 220kV a 400kV - 2012

Espacio

© ABB

Ejemplo – Optimización del Espacio
Simbach (Alemania) – de 220kV a 400kV - 2012

Espacio

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Beneficios de las GIS
…aún cuando abunde el terreno!

Flexibilidad

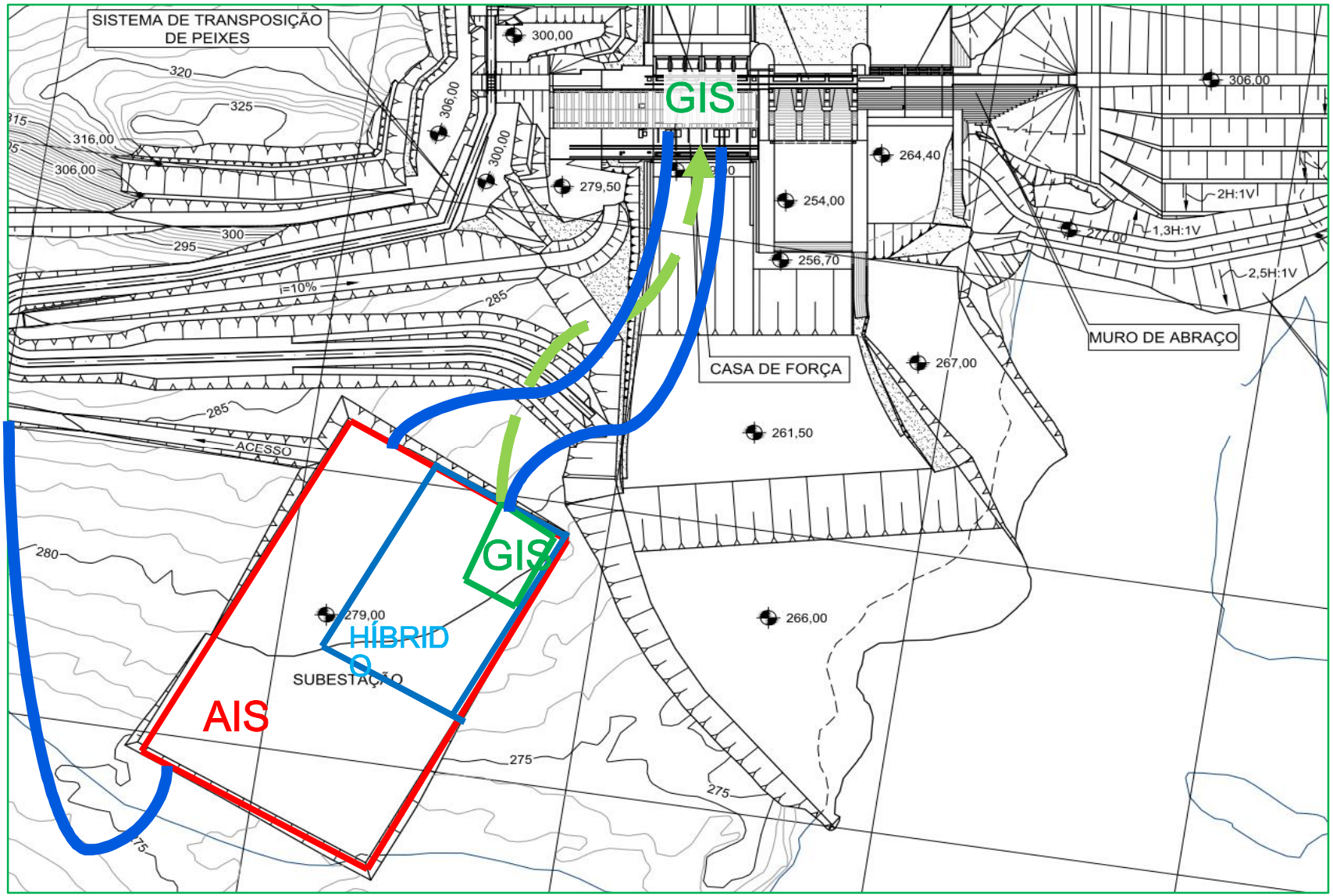
Sus beneficios

- Flexibilidad en la ubicación
- Licencias ambientales
- Reducir el tiempo en sitio
- Reducir el personal en sitio
- Hacer el proyecto viable

© ABB Group

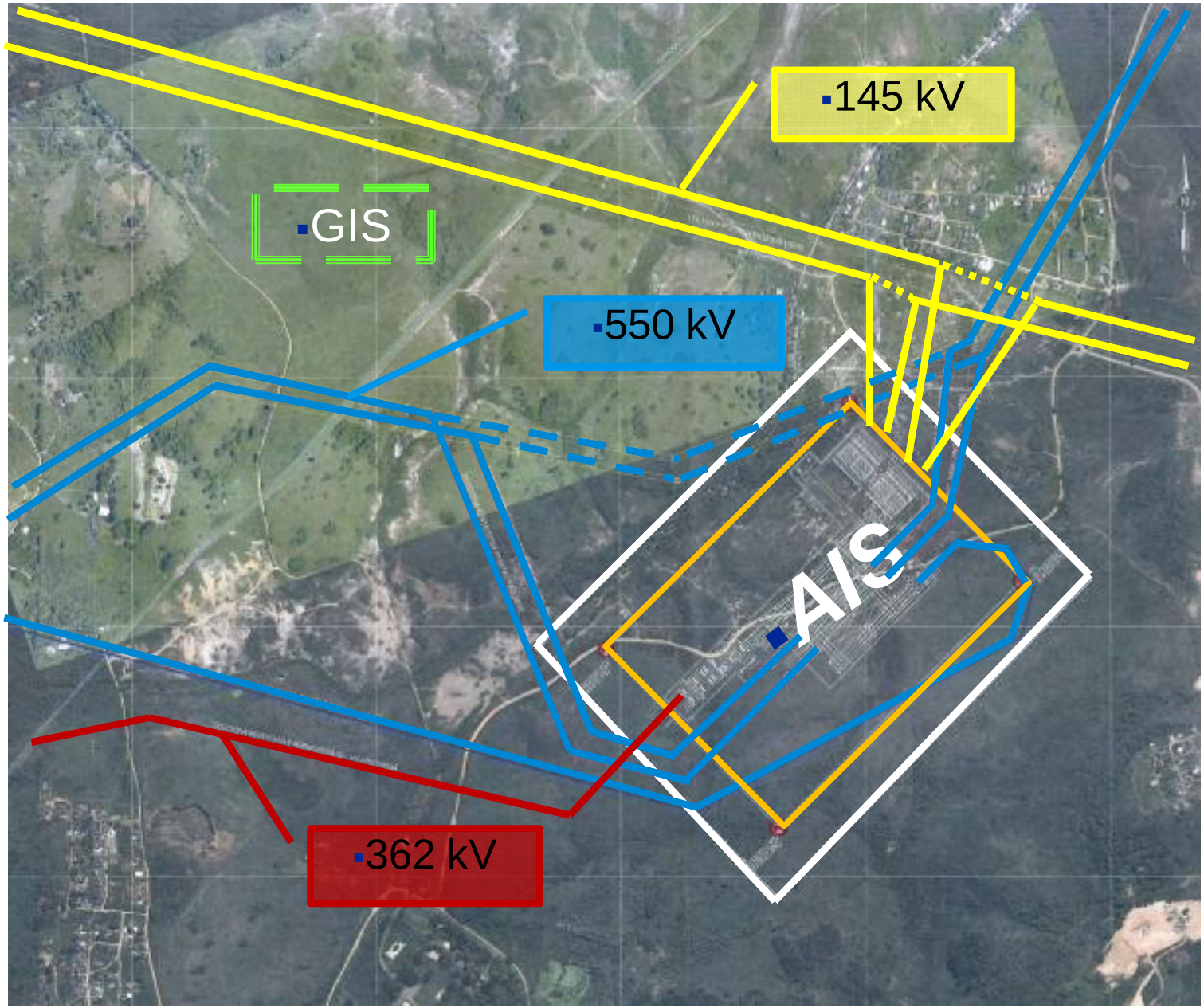
Beneficios de las GIS
…aún cuando abunde el terreno!

Flexibilidad



Beneficios de las GIS
…aún cuando abunde el terreno!

Flexibilidad



Beneficios de la GIS
Largos intervalos de mantenimiento

Bajo manten.

Aplicaciones

- Parques eólicos off-shore
- Plataformas petroleras

Características

- Largos intervalos de mantenimiento
- Fiabilidad

Sus benficios

- Sin apagones en SE remotas
- Ahorro de costes por espacio reducido

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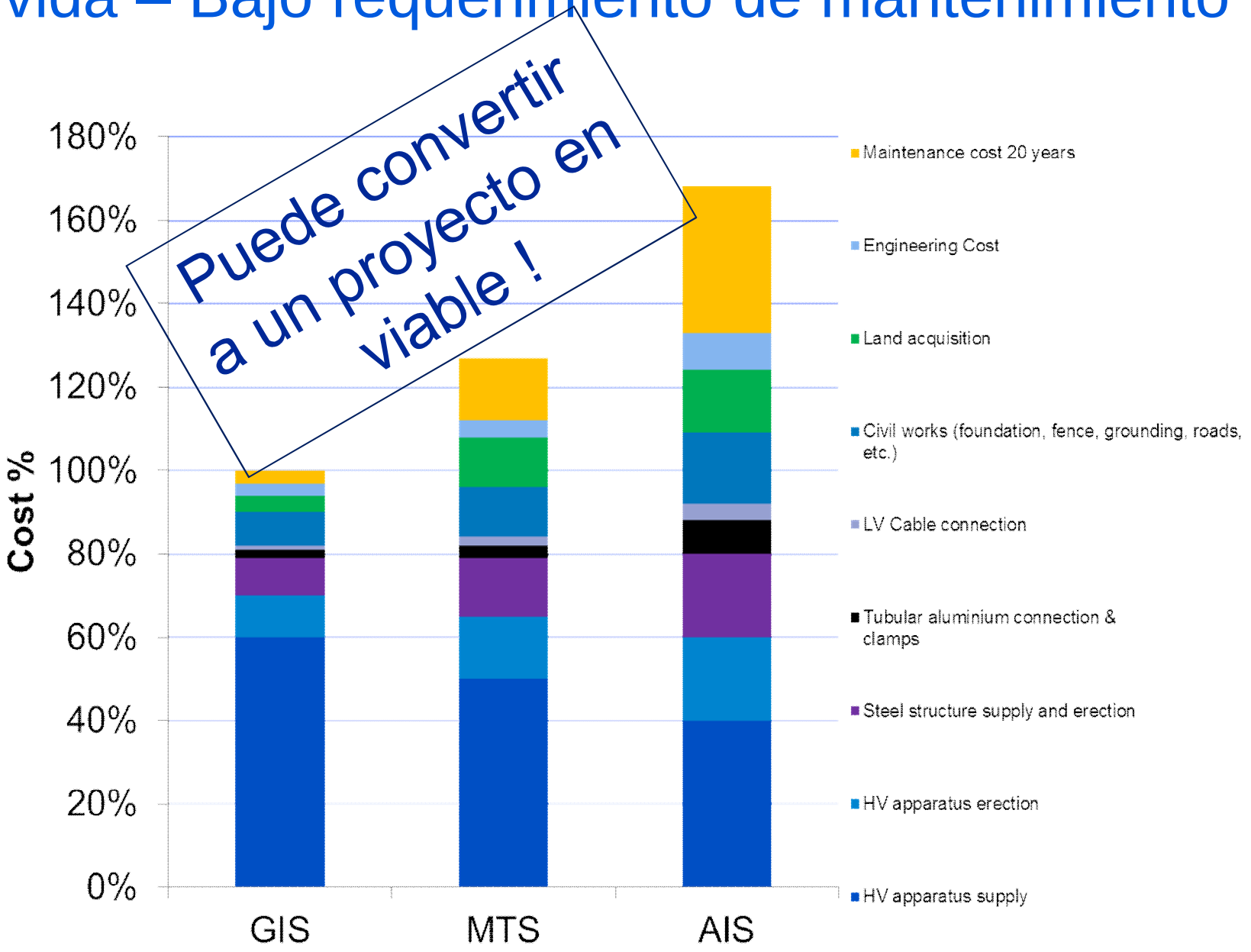
Beneficios de la GIS
Ciclo de vida – Bajo requerimiento de mantenimiento

Ciclo de Vida



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Beneficios de la GIS
GIS en contenedores – Estaciones móviles

Entrega ensamblada de fábrica

Aplicaciones

- Bypass SE para remodelaciones
- Rápido fortalecimiento de la red

Sus beneficios

- Rápida instalación
- Ingeniería civil minimizada

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ONS – Autoridad Eléctrica Brasileña
Ejemplo de requerimiento mínimo

Nivel Fiabilidad

ONS Operador Nacional do Sistema Elétrico

Procedimentos de Rede

Assunto	Submódulo	Revisão	Data de Vigência
REQUISITOS MÍNIMOS PARA TRANSFORMADORES E PARA SUBESTAÇÕES E SEUS EQUIPAMENTOS	**2.3**	**1.1**	**16/09/2010**

5.2 Esse atendimento compreende projeto, fabricação, manutenção e operação das instalações referidas no item 1.7 deste submódulo.

6 INSTALAÇÕES DA SUBESTAÇÃO

6.1 Arranjo de barramento

6.1.1 Condições básicas

6.1.1.1 Os arranjos de barramentos para subestações com isolamento a ar da rede básica são estabelecidos nos grupos abaixo, diferenciados por classe de tensão:

(a) Barramentos de tensão igual ou superior a 345 kV: barra dupla com disjuntor e meio; e

(b) Barramentos de 230 kV: barra dupla com disjuntor simples a quatro chaves.

6.1.2 Condições especiais

6.1.2.1 Arranjos de barramento alternativos podem ser utilizados, inclusive os de tecnologia com isolamento em SF-6, desde que apresentem desempenho igual ou superior ao dos arranjos estabelecidos no item 6.1.1.1 deste submódulo, o que deve ser comprovado pelo agente por meio de estudos de confiabilidade e disponibilidade (saída forçada e programada). Além disso, esses arranjos devem atender ao que estabelece o item 4.1 deste submódulo.

6.1.2.2 Os arranjos de barramento alternativos referidos no item 6.1.2.1 deste submódulo devem

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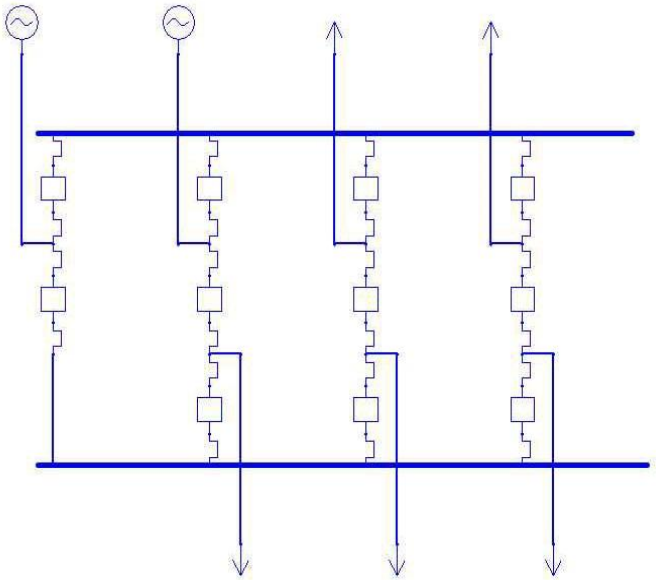
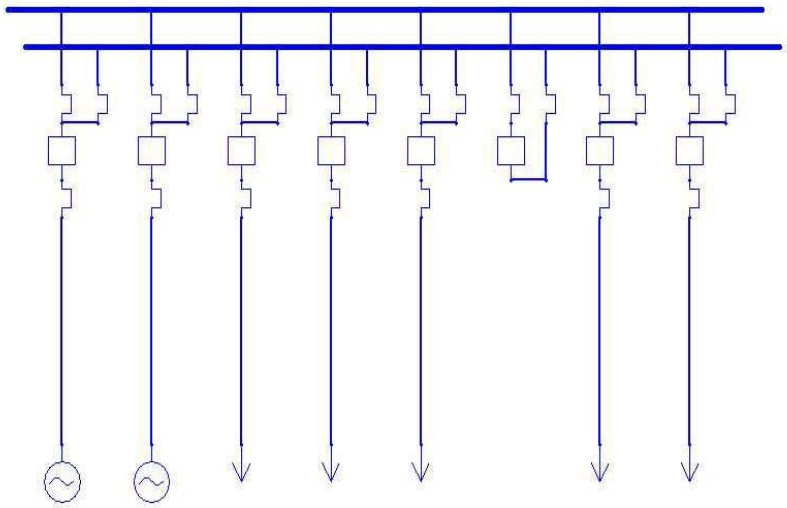
Comparación GIS vs AIS
Configuración DBB vs 1 ½ CB

Nivel Fiabilidad



AIS

Vs

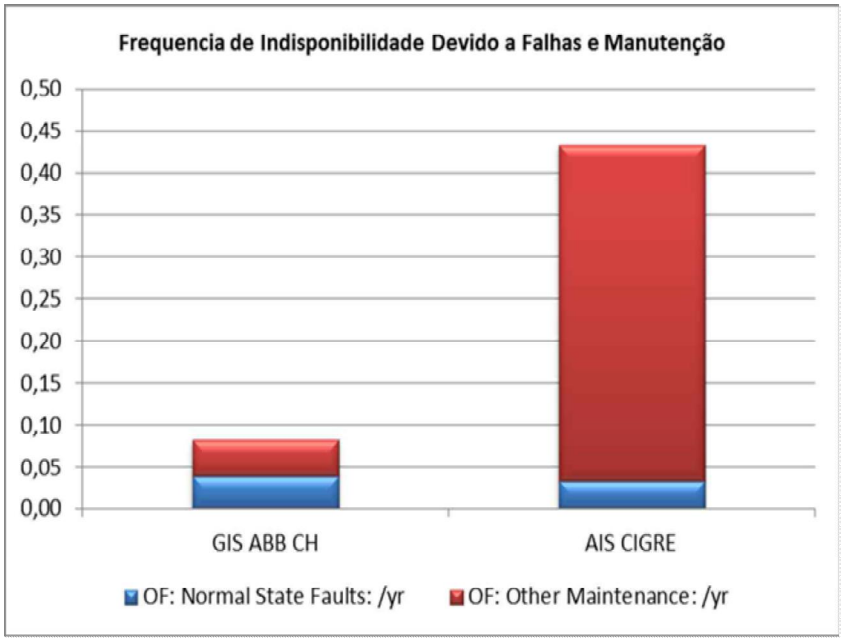


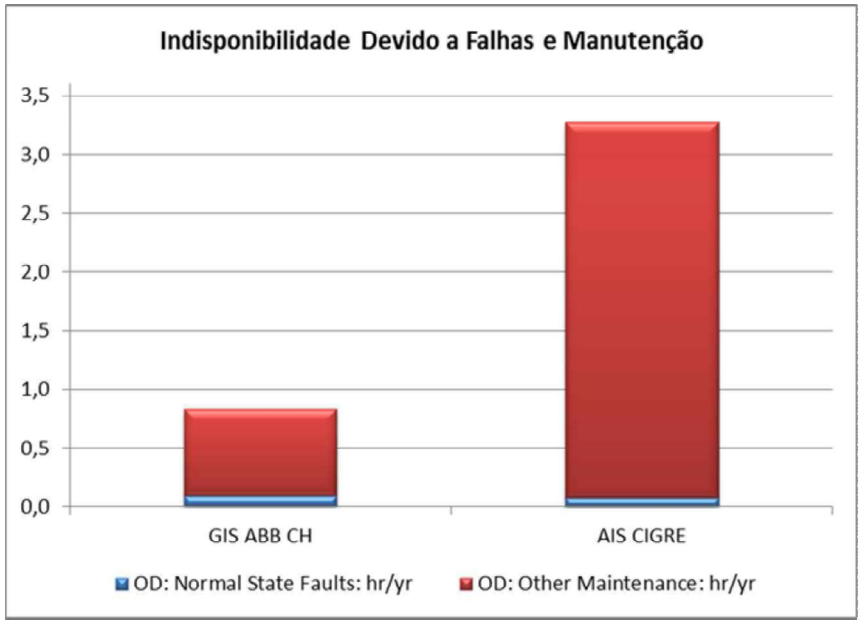
GIS

© ABB Group

GIS vs AIS comparison
Configuration: DBB vs 1 ½ CB

Nivel Fiabilidad





Source:

- *CIGRE Brochure 510 - HV Equip Reliability Part 2 - Circuit Breaker.*
- *CIGRE Brochure 513 - HV Equip Reliability Part 5 GIS*
- *Maintenance and Repair Concept including Instructions Special Tools, 1HC0081026*

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Gas Insulated Switchgear (GIS)

GIS Particularidades técnicas de la GIS

Transferencia de barras

Power and productivity
for a better world™
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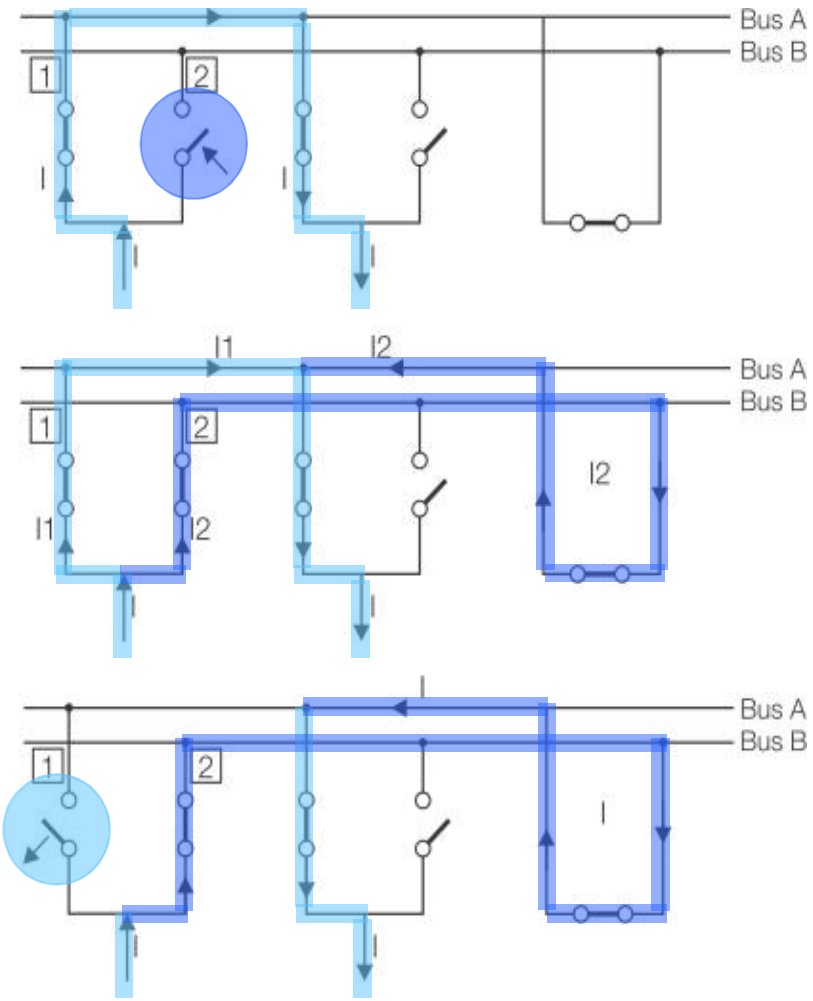
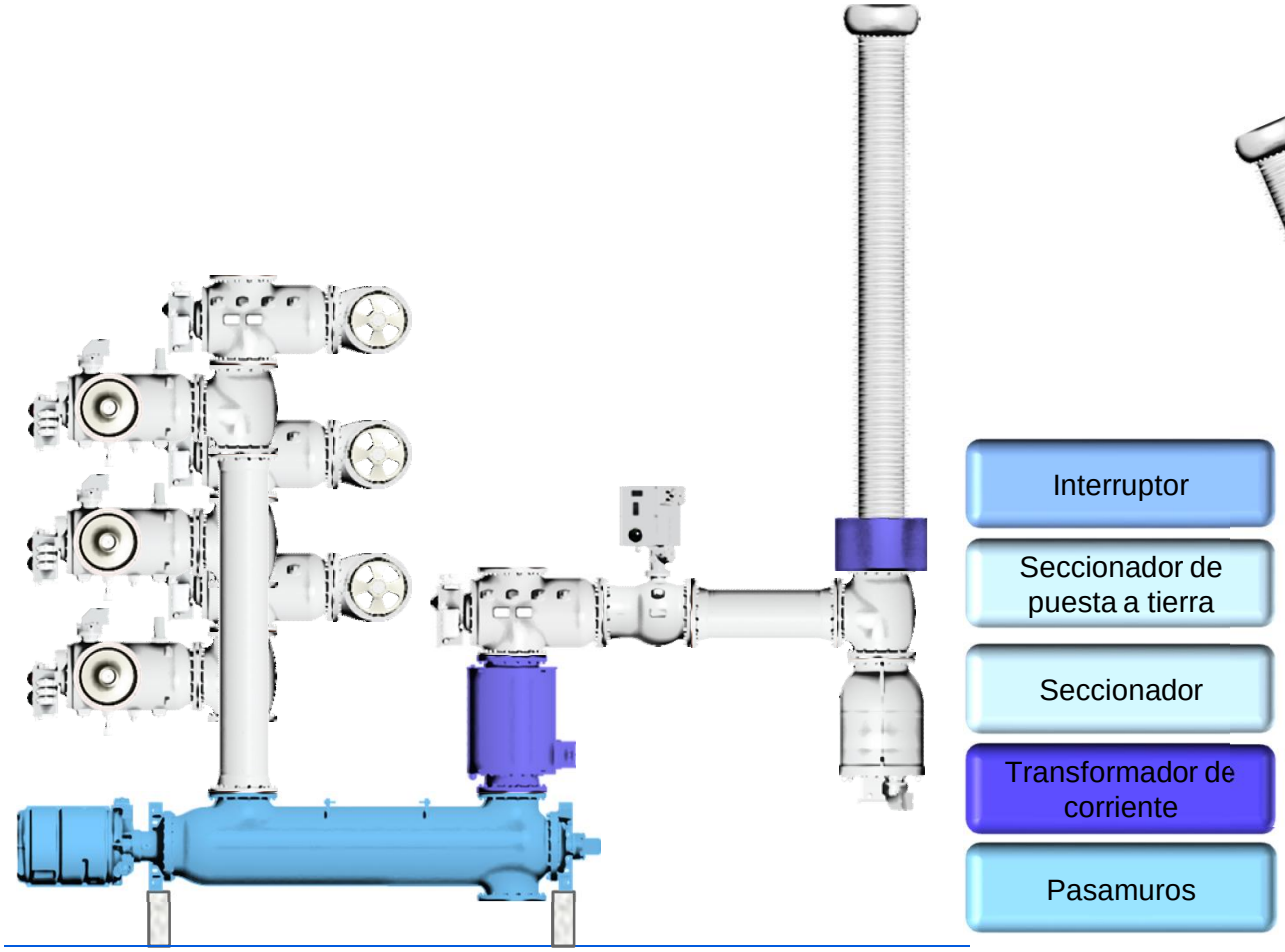
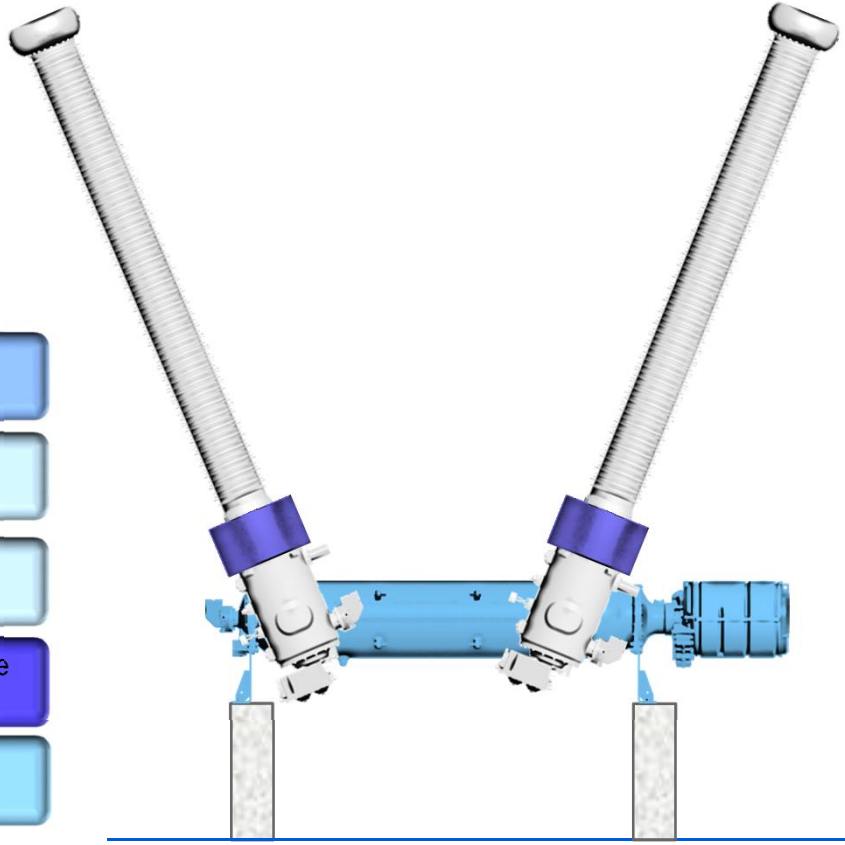
ELK-TK3S
Transferencia de Barras



Módulos ELK híbridos
Componentes idénticos para GIS y ELK híbrida



- Interruptor
- Seccionador de puesta a tierra
- Seccionador
- Transformador de corriente
- Pasamuros



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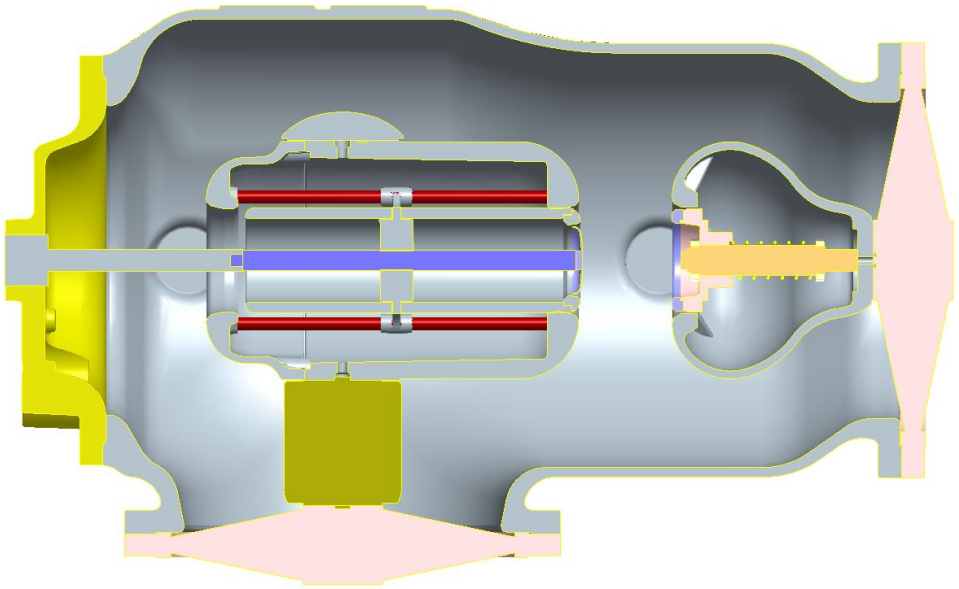
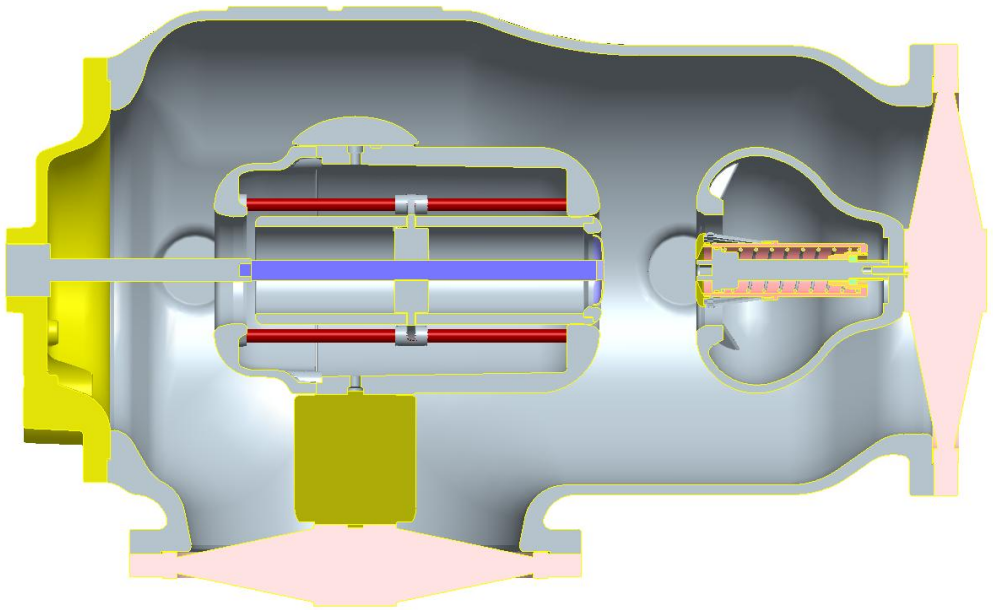
ELK-TK3S
Comparación Seccionador tipo ELK

- Seccionador ELK-TK3



- Acción rápida ELK-TK3S



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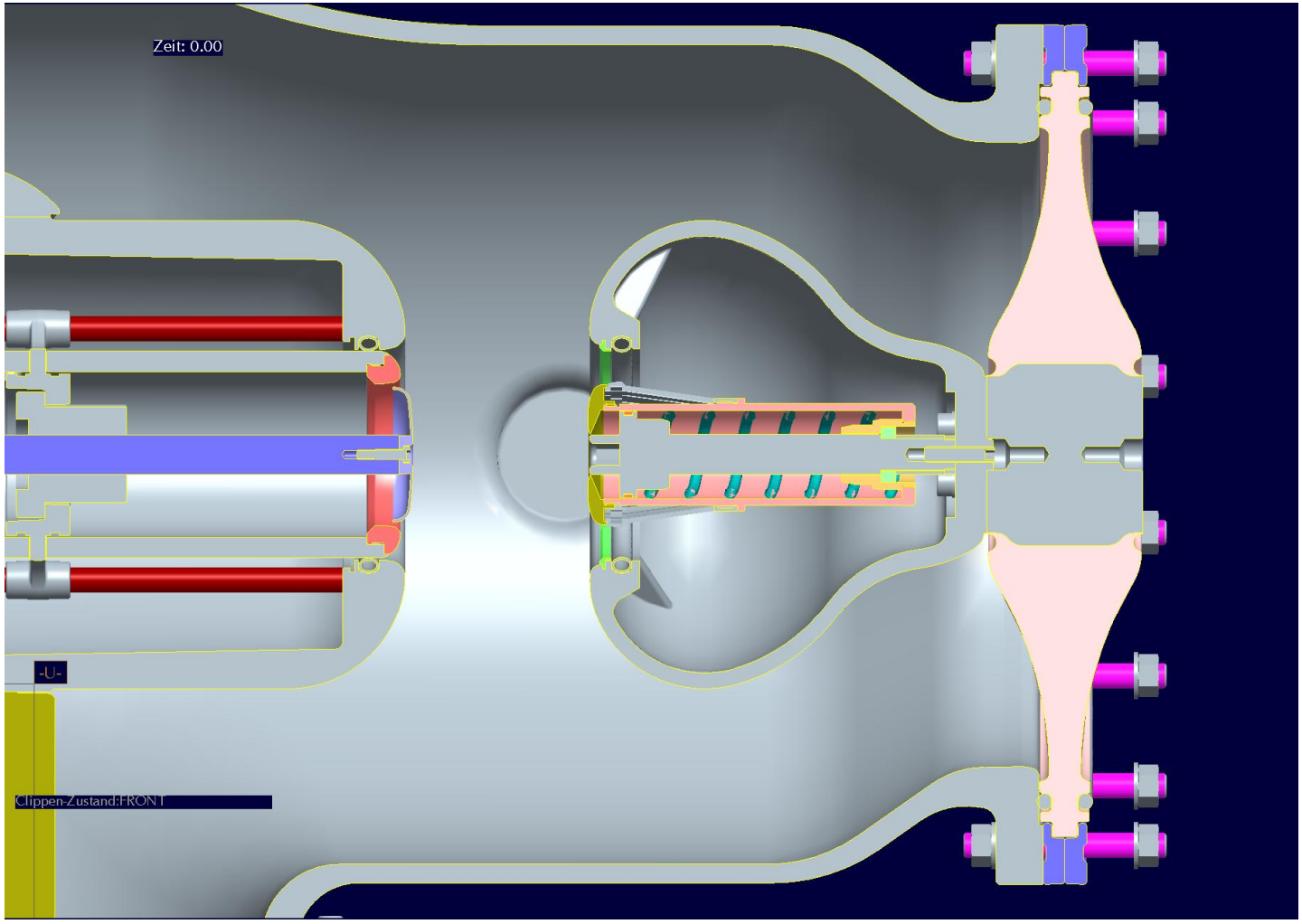
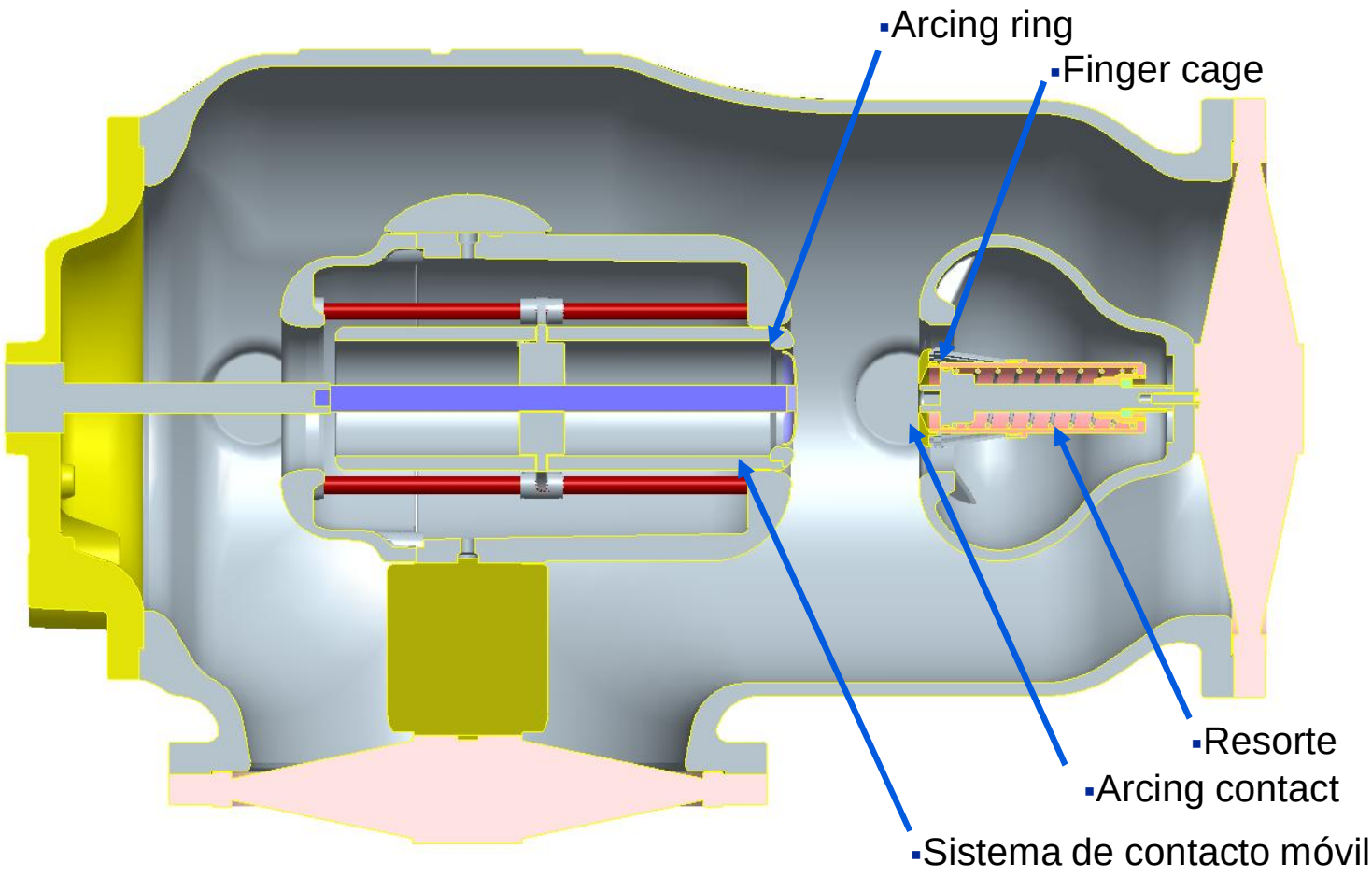
ELK-TK3S
Principio de funcionamiento



May 5, 2015 | Slide 54

ELK-TK3S
Seccionamiento Rápido



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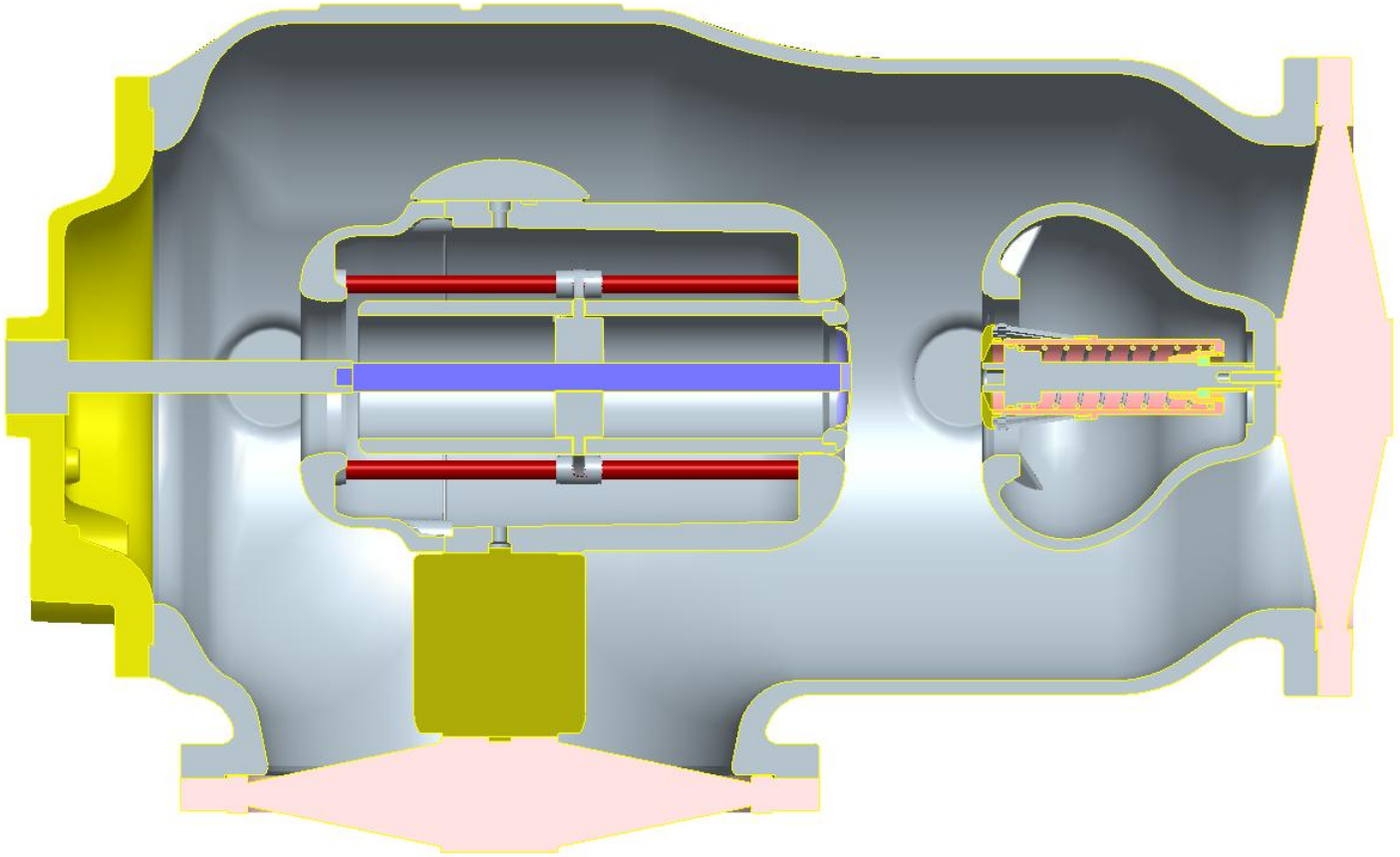
ELK-TK3S
Seccionador abierto



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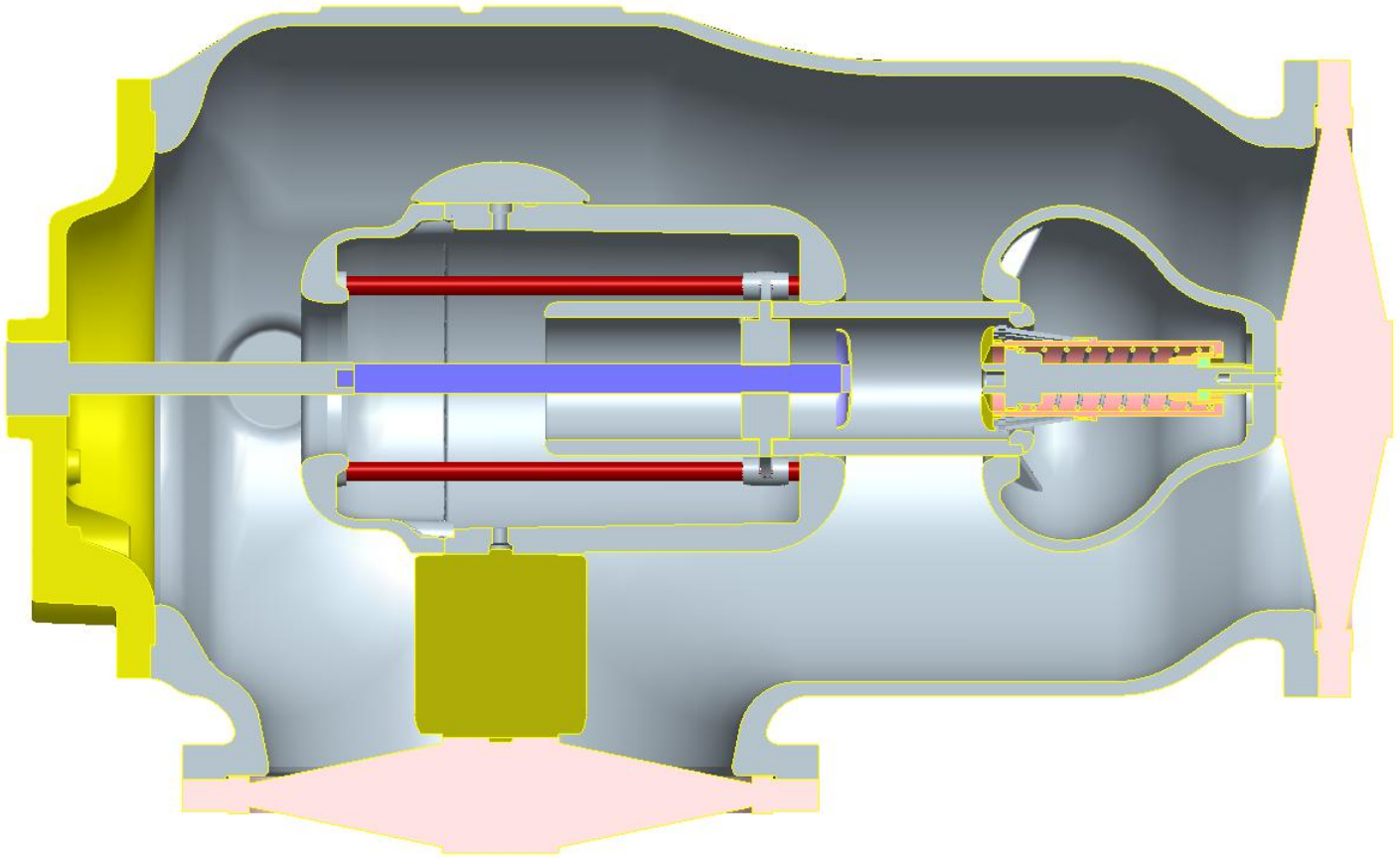
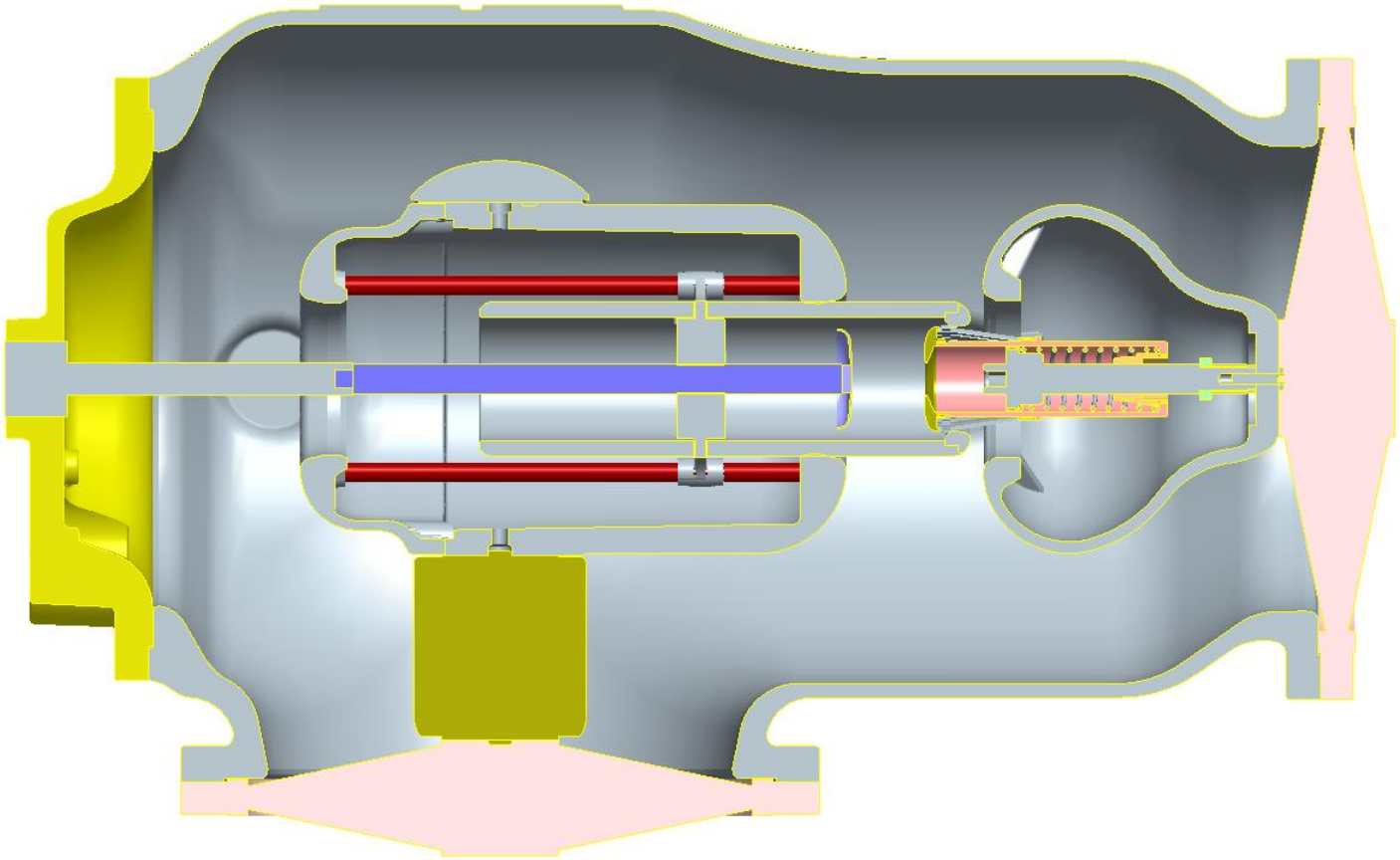
ELK-TK3S
Seccionador cerrado



ELK-TK3S
Seccionador abriendo



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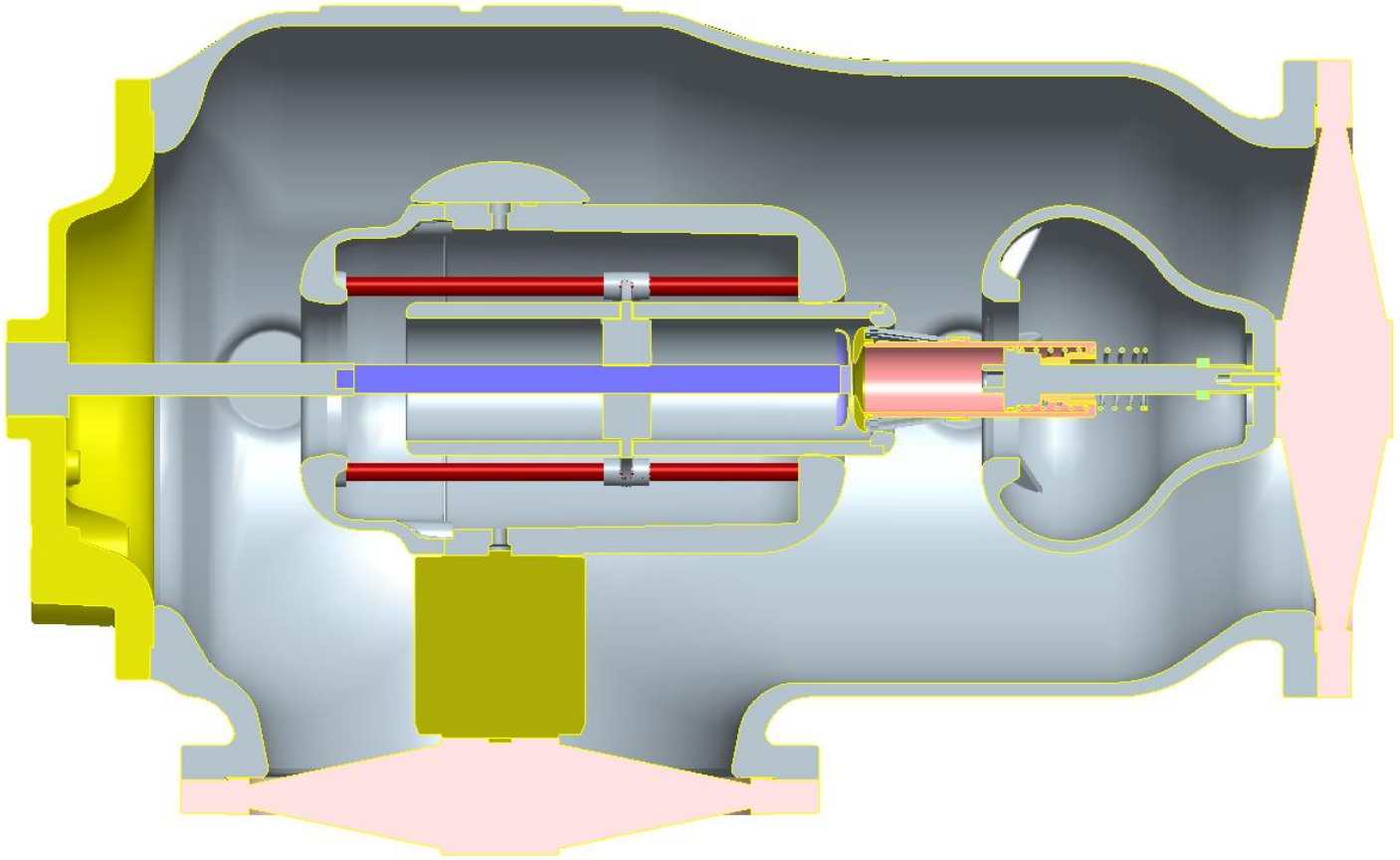
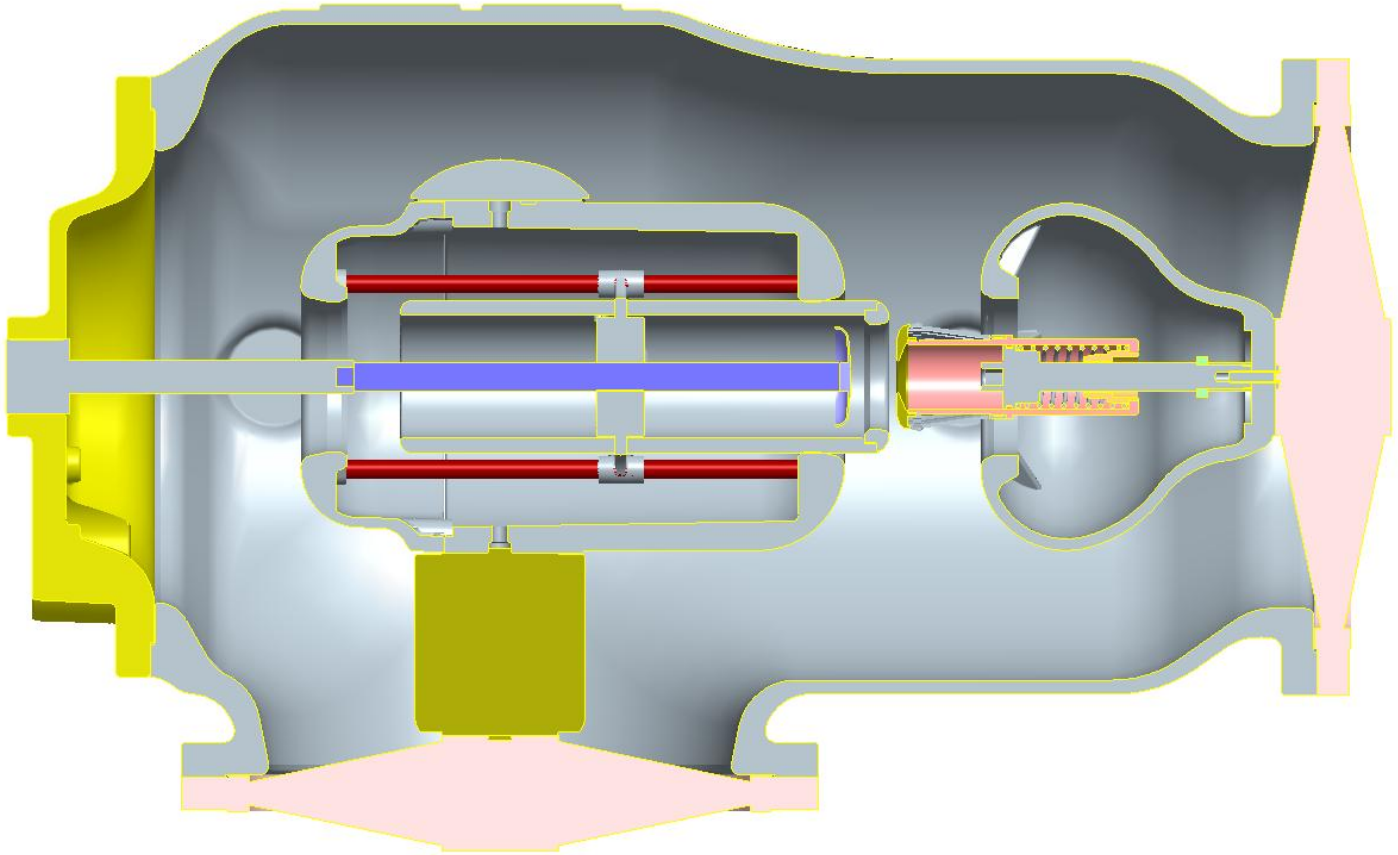
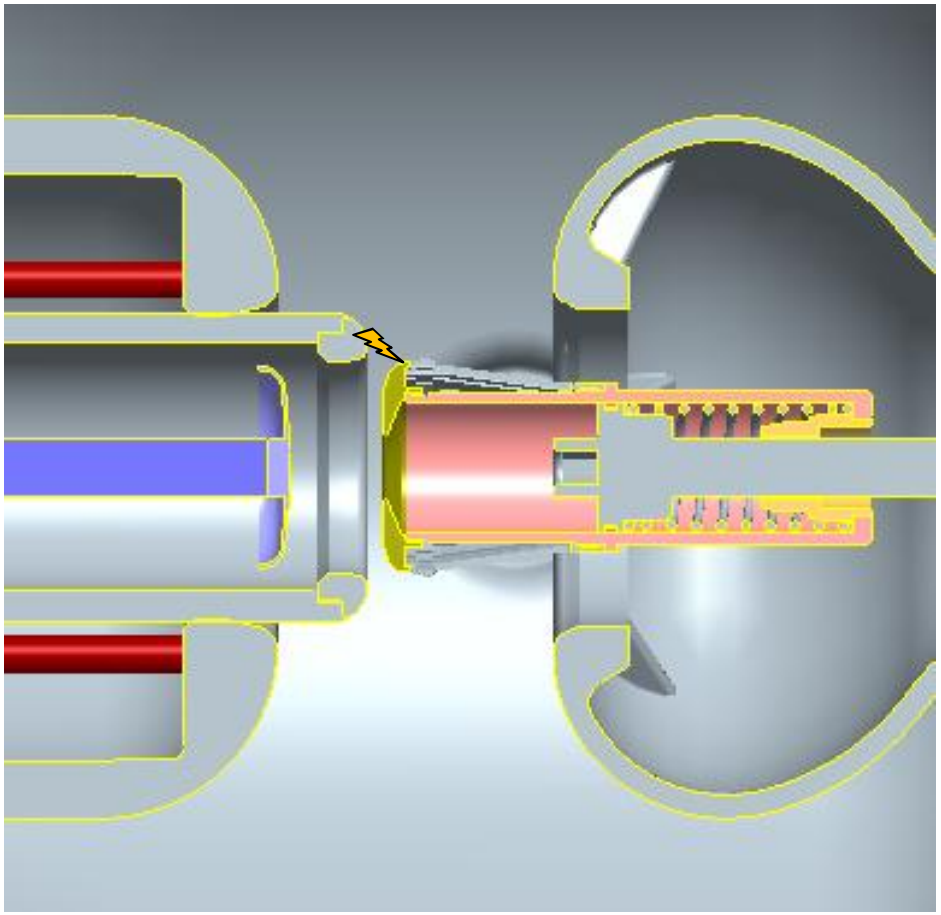
ELK-TK3S
Disconnector opening



ELK-TK3S
Disconnector opening



ELK-TK3S
Disconnector opening



Tensiones estándar - Tranf. barras - Seccionadores . IEC 62271-102

Tensión nominal U_r kVA	AIS seccionadores V r.m.s.	GIS seccionadores V r.m.s.
52 72.5 100 123 145 170	110	10
245 300 362	200	20
420	300 IEC 1600 A / **ABB 3200 A**	
550 800		40

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ELK-TK3S
Prueba tipo en PHELA pasada exitosamente

Tests performed:

Bus transfer current switching tests (100 CO operations), single pole tests at 50 Hz,
with rated bus-transfer current: 3200 A and rated bus-transfer voltage: 300 V
Condition check with applied voltage 520 kV phase to earth and 2x326kV=652kV across insulating distance.

Test results:

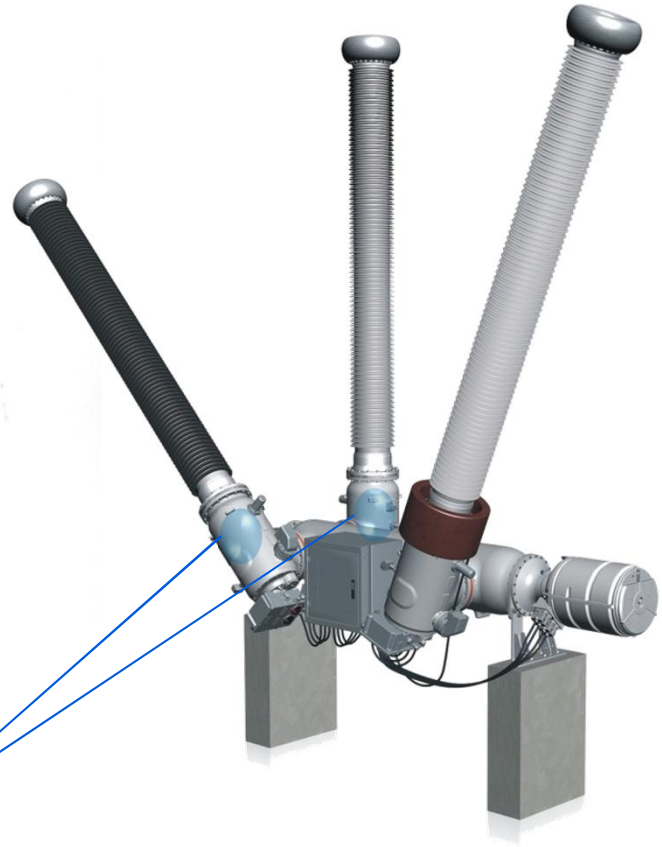
The test object met the requirements of the test specification with respect to behaviour during the tests and the condition after the tests. The test object passed the tests.

GESELLSCHAFT FÜR ELEKTRISCHE HOCHLEISTUNGSPRÜFUNGEN

Management Committee

Technical Committee

Mannheim, 22. February 2013



3200 A

300 V

100 CO, DIT

Gas Insulated Switchgear (GIS)

GIS Particularidades técnicas de la GIS

Compartimentación de Gas

Power and productivity
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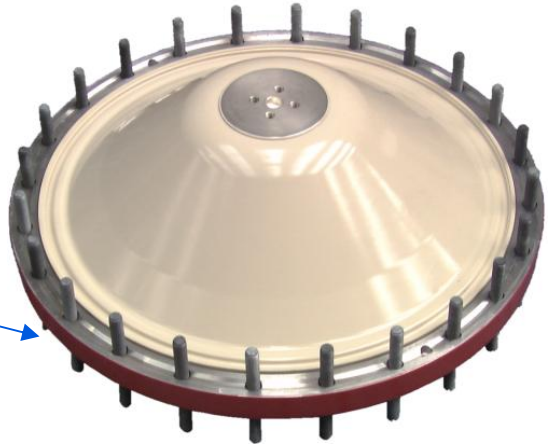
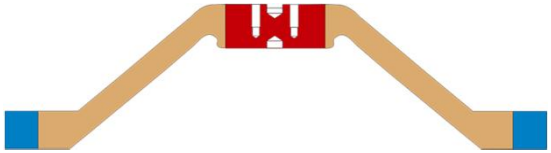
ELK-3, 550kV
Aisladores

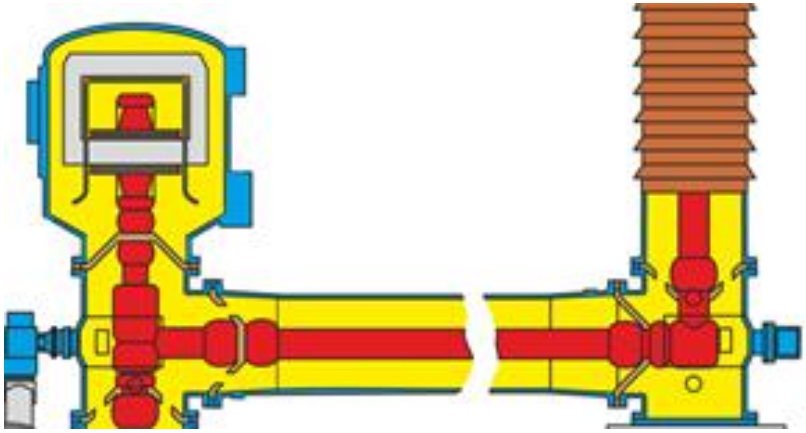
Aislador

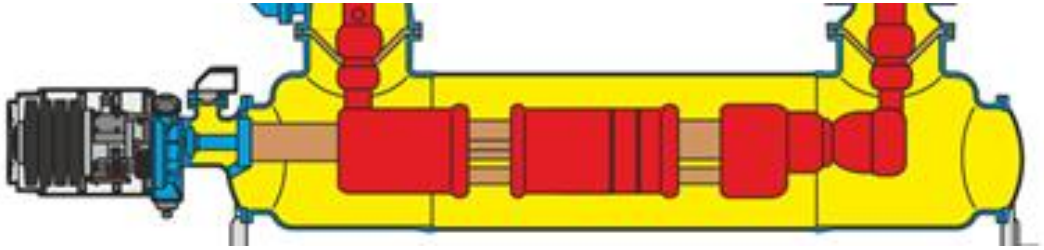




Soporte

ELK-3, 550 kV
Aisladores





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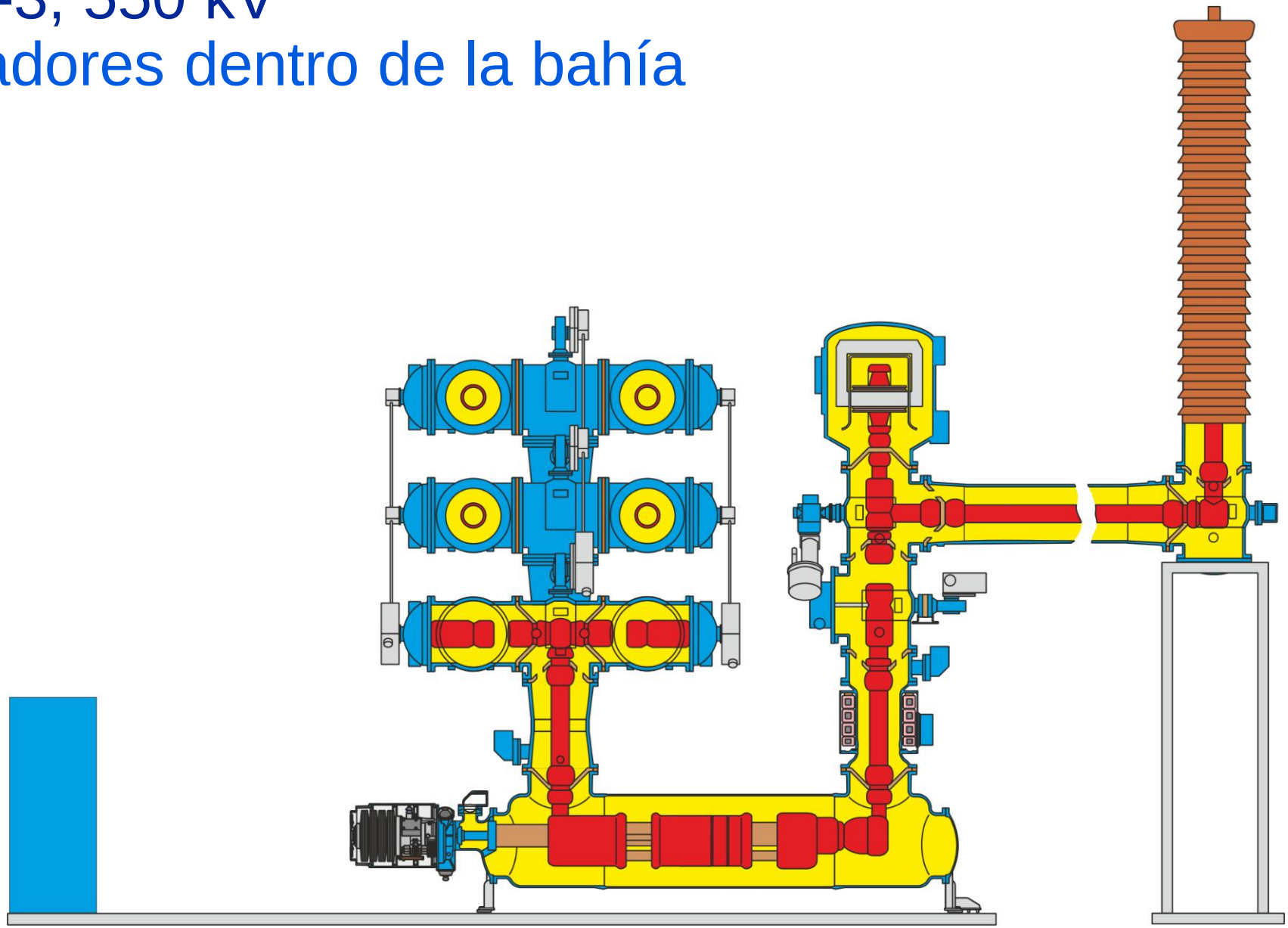
ELK-3, 550 kV
Aisladores dentro de la bahía



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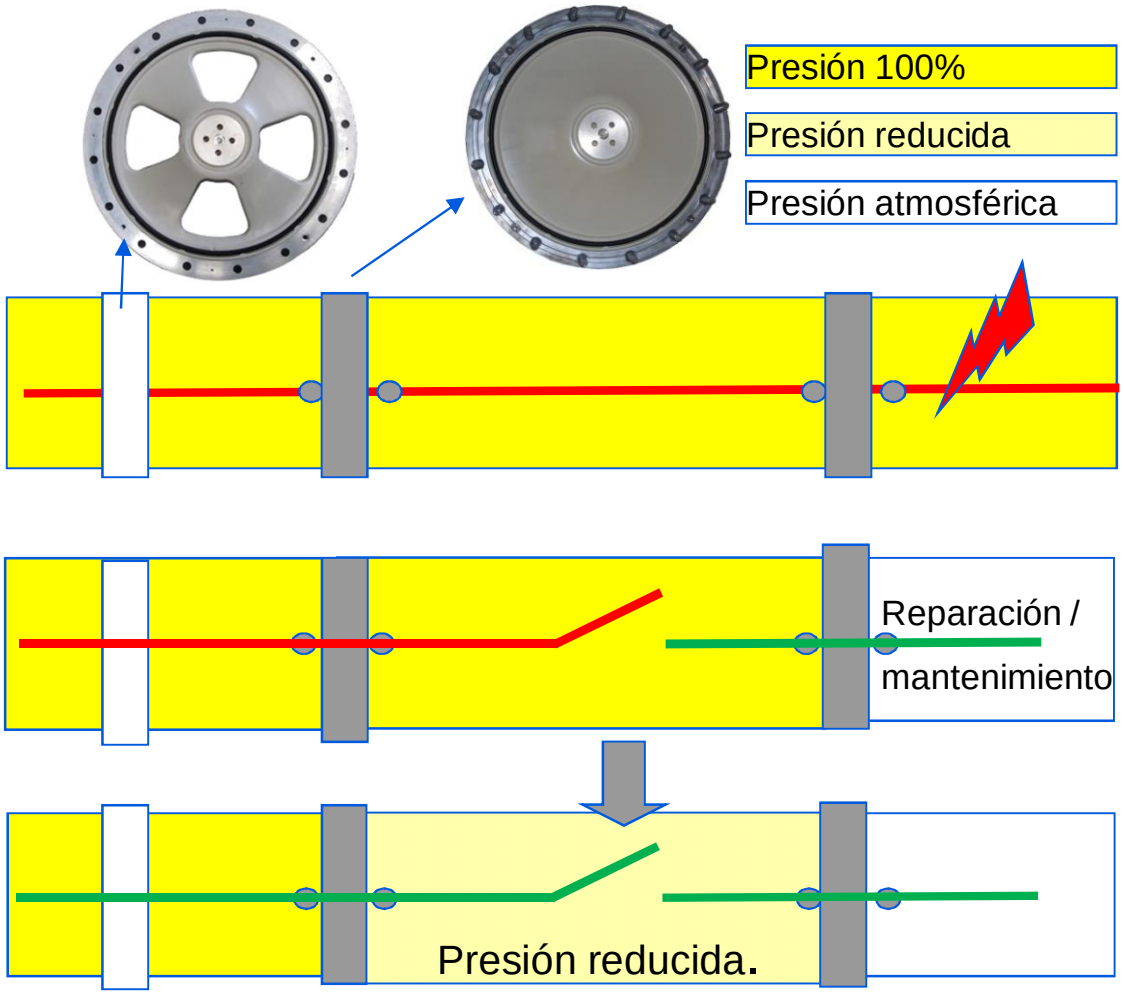
Concepto de compartimentación
Consideraciones de seguridad



En tensión

A tierra

Remover el gas..
Regulaciones de seguridad pueden prohibir trabajar al lado de una barrera presurizada que ha sido expuesta a un arco…

…por tanto, debe reducirse la presión en el compartimiento adyacente…

Consecuencia = presión reducida significa capacidad dieléctrica reducida

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Impacto compartimentación en continuidad del servicio
IEC 62271-203ed 2.0, recomendaciones – Anexo F

Examples of how partitioning of GIS may affect service continuity are given below.

In some arrangements the two busbar-disconnectors are separated by only one partition. In Figure F.101, the consequences of the removal of the gas compartment partition at 'A' requires both busbars of a double busbar substation to be isolated, with the loss of all feeders on that section of busbar for the duration of the repair.

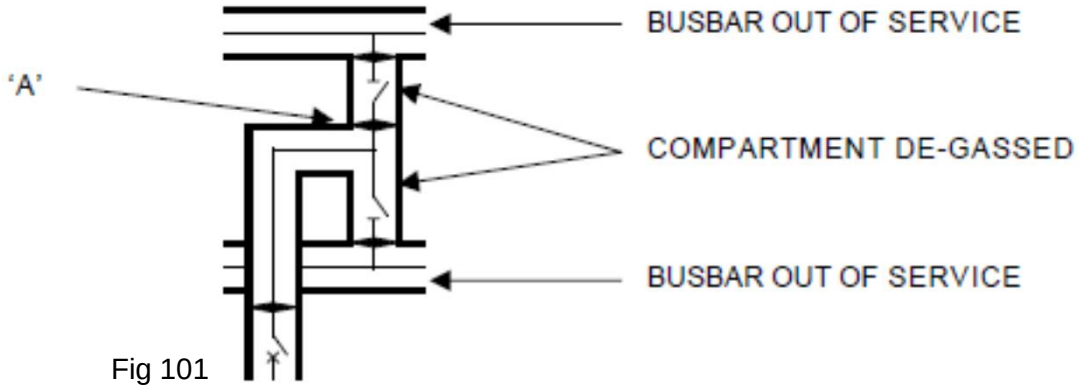

Fig 101

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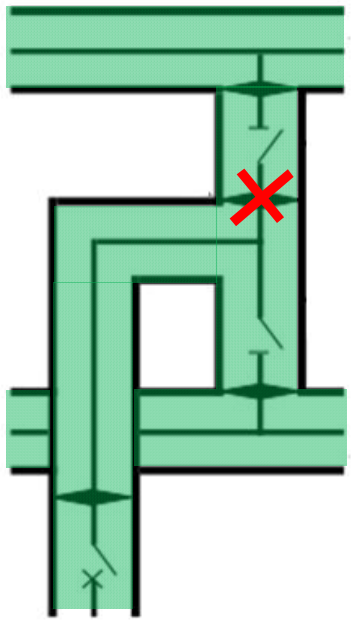
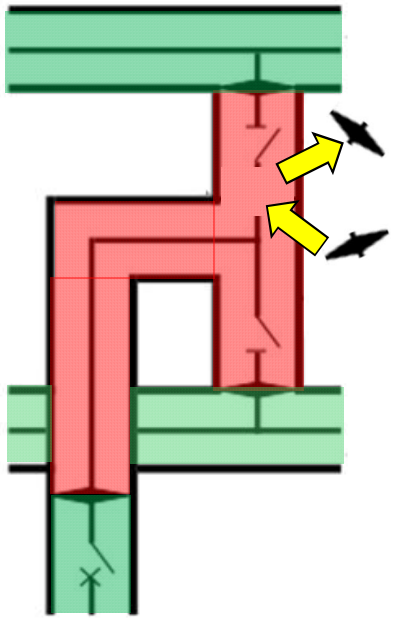
Ejemplo de cómo la compartimentación de la GIS
Puede afectar la continuidad del servicio

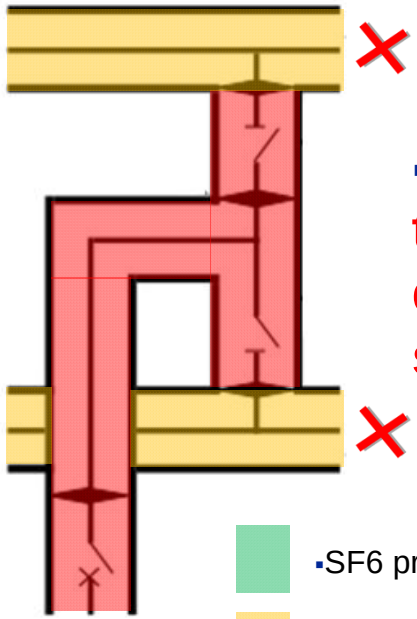
Reparacón del aislador



Entre falla y reparación el compartimiento debe ser desenergizado



Presión en los compartimientos adyacentes debería ser reducida por motivos de seguridad

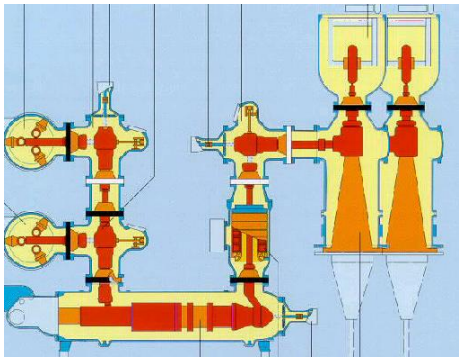


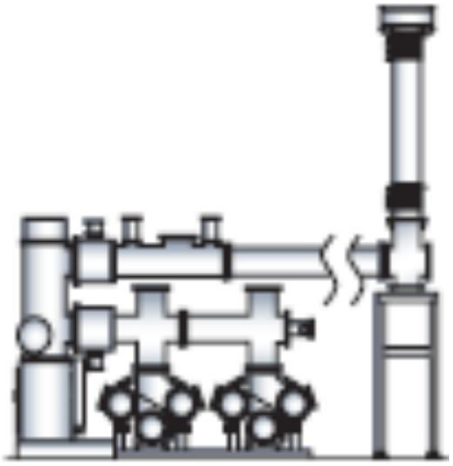
- **Ambas barras y todas las salidas quedan fuera de servicio**

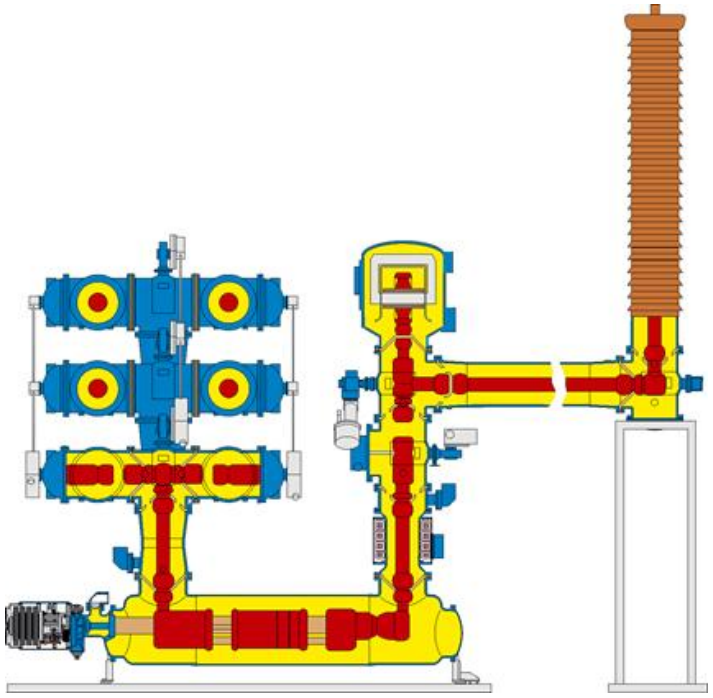
- SF6 presión de operación
- SF6 presión reducida
- Presión atmosférica (sin gas)

Impacto compartimentación en continuidad del servicio IEC 62271-203ed 2.0, recomendaciones – Anexo F

Diferentes soluciones de diferentes fabricantes:







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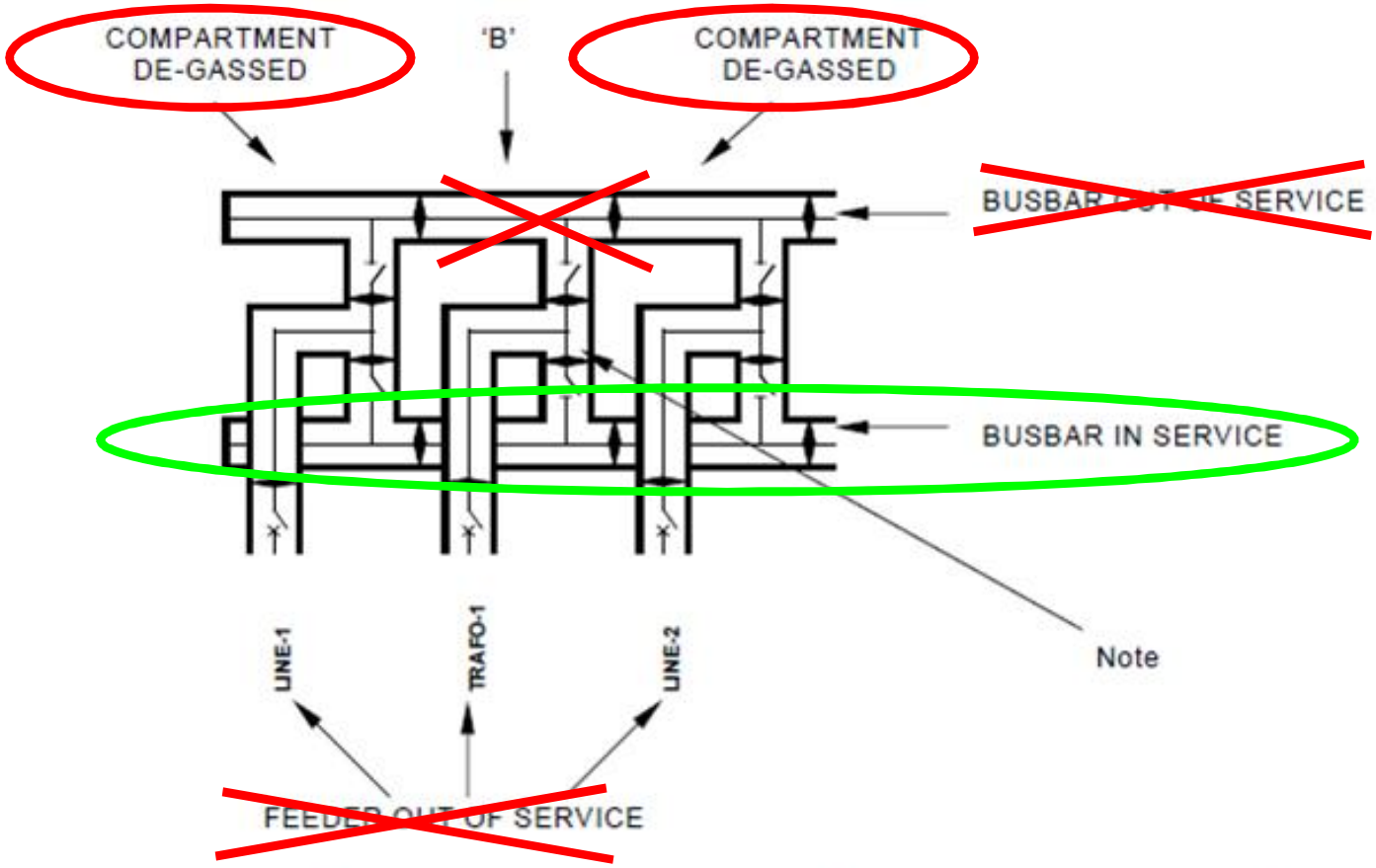
Impacto compartimentación en continuidad del servicio
IEC 62271-203ed 2.0, recomendaciones – Anexo F

In Figure F.102 the removal of the disconnector, including its partitions, at 'B' requires the compartments of the adjacent disconnectors to be de-gassed. This causes the loss of the associated feeders for the duration of the repair.



NOTE If working adjacent to a pressurised partition is not allowed an outage of the second busbar could be needed also.

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Requerimientos del usuario en continuidad del servicio IEC 62271-203

It is the responsibility of users to define a strategy of maintenance relatively to the impact on service continuity and, it is the responsibility of manufacturers to design and define partitioning in order to fulfil users need.

The service continuity requirements should achieve an appropriate balance between equipment cost and the criticality of the substation in the user's network.

The user may define some general statements that allow a quantitative assessment of the service continuity during maintenance, repair or extension. The following general statements are given as examples:

- At least one line- and transformer-feeder must remain in service during maintenance and repair
- Maximum one busbar and one feeder permitted out of service during maintenance and repair
- The power flow must be maintained between specified feeders during extension

«*El usuario puede definir los lineamientos generales que permitan evaluar la continuidad del servicio durante mantenimiento, reparación o extensión. Los siguientes son algunos ejemplos*»:

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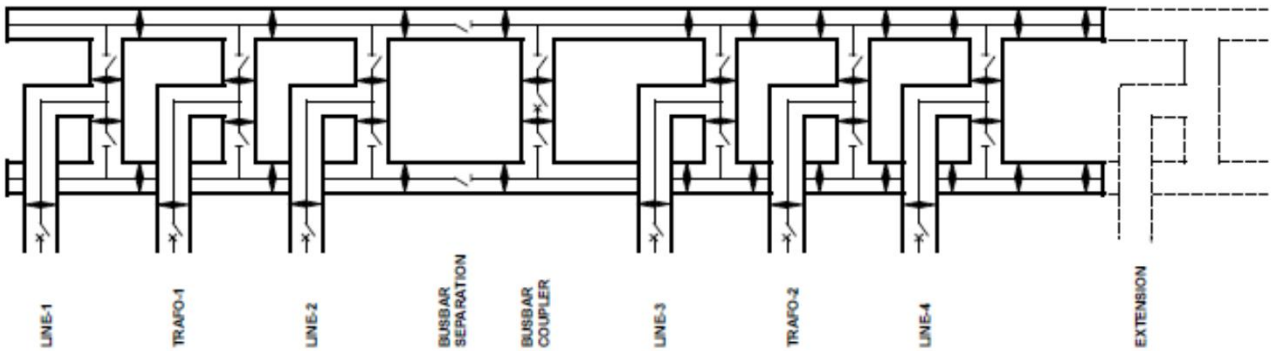
Ejemplo requerimiento detallado para continuidad del servicio
IEC 62271-203



Feeders or part of the substation	Maintenance → See Annex F.3.1		After failure until repair → See Annex F.3.2.1		Repair or replacement of a busbar disconnector after failure → See Annex F.3.2.2		Dielectric test → See Annex F.3.4		Extension → See Annex F.3.3	
	Service continuity 1)	Accepted duration (days) 2)	Service continuity 1)	Accepted duration (days) 2)	Service continuity 1)	Accepted duration (days) 2)	Service continuity 1)	Accepted duration (days) 2)	Service continuity 1)	Accepted duration (days) 2)
LINE-1										
TRAFO-1										
LINE-2										
BUSBAR-SEPARATION										
BUS-COUPLER										
LINE-3										
TRAFO-2										
LINE-4										
EXTENSION "RIGHT"										

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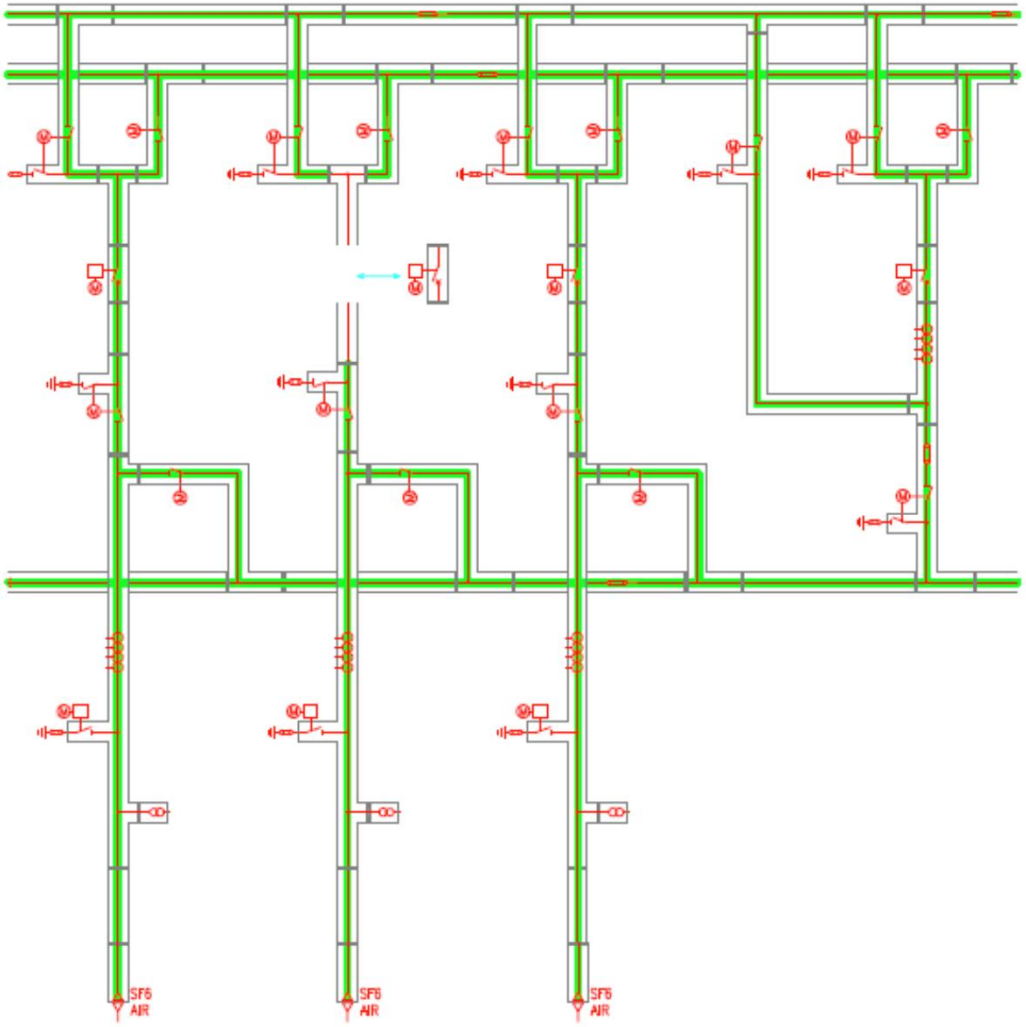
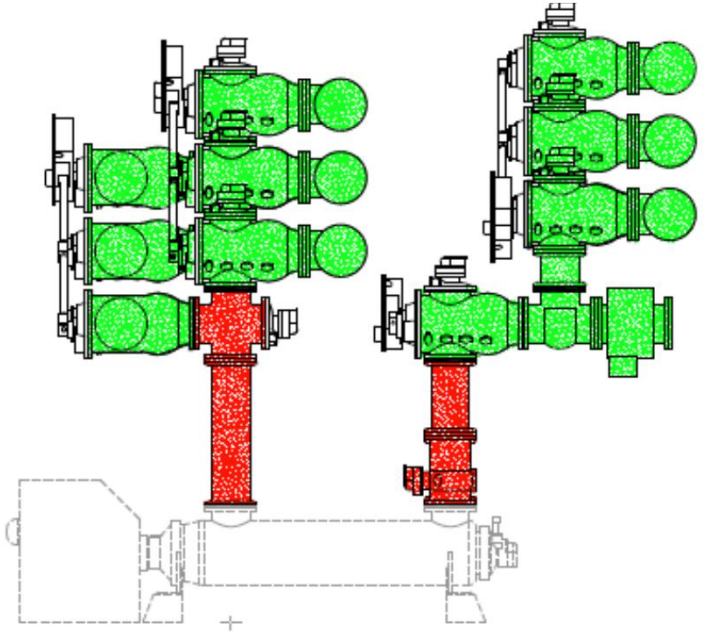
Impact of physical arrangement & partitioning
Removal of circuit breaker





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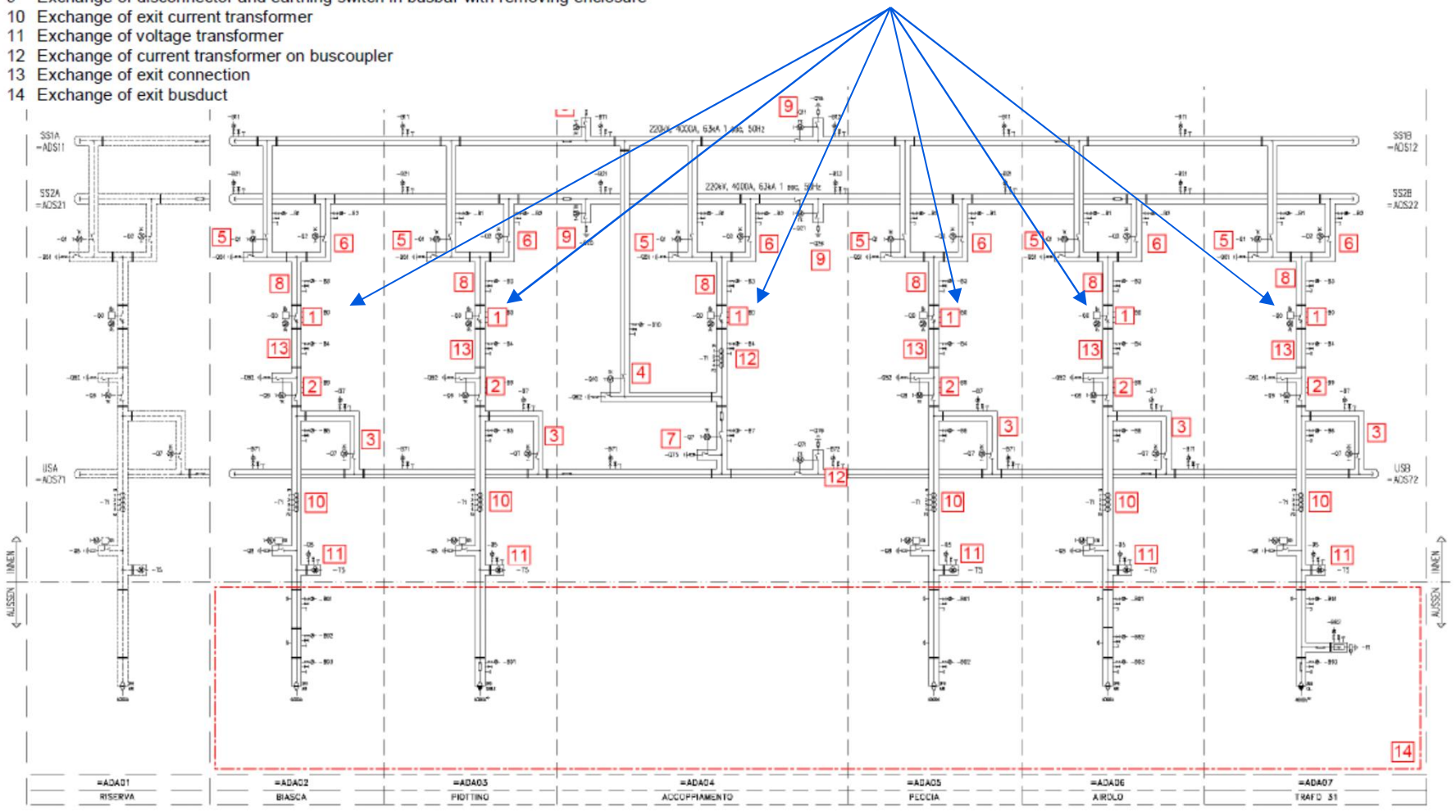
Ejemplo para reparación y mantenimiento
Diagrama esquemático de gas

2 Description of the inspection and repair cases

1 Exchange of the complete circuit-breaker
2 Exchange of the exit disconnector and earthing switch with removing enclosure
3 Exchange of the auxiliary bus disconnector with removing enclosure
4 Exchange of the bypass disconnector and earthing switch with removing enclosure
5 Exchange of the BB I disconnector and earthing switch with removing enclosure
6 Exchange of the BB II disconnector switch with removing enclosure
7 Exchange of the auxiliary bus disconnector with removing enclosure
8 Exchange of the VX/VG connection housing with removing enclosure
9 Exchange of disconnector and earthing switch in busbar with removing enclosure
10 Exchange of exit current transformer
11 Exchange of voltage transformer
12 Exchange of current transformer on buscoupler
13 Exchange of exit connection
14 Exchange of exit busduct

«*1.- Sustitución del interruptor completo*»



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May 5

Ejemplo para reparación y mantenimiento
Substitución del interruptor completo

1

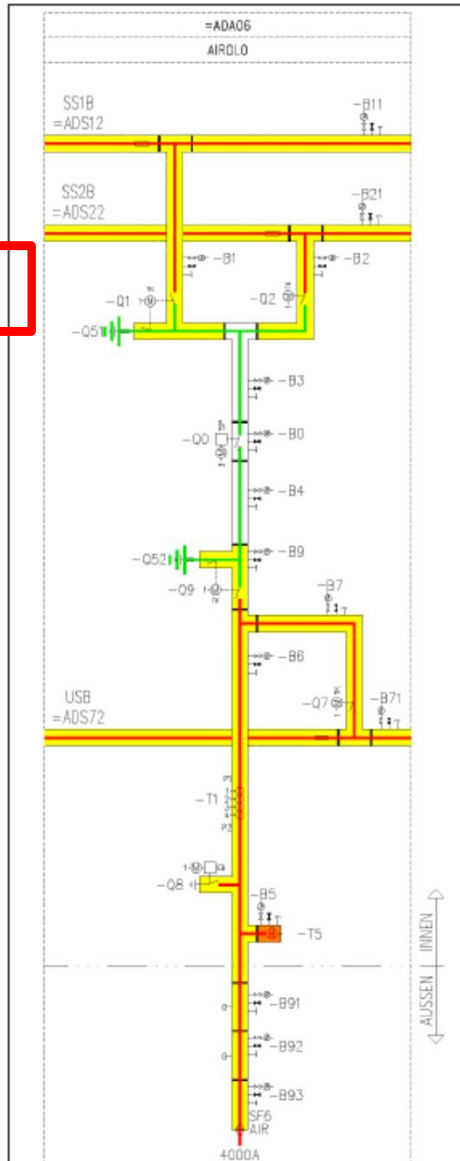

Figure 1

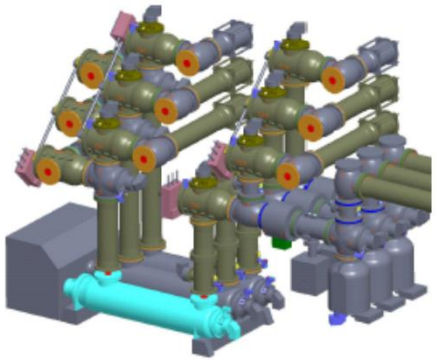
Figure 2

Legend for gas schematic diagram

	In service
	Out of service and earthed
	Ambient pressure (air)
	SF6 (max 530kPa)
	SF6 (680kPa)

GIS Parts in Service

	In service	Out of service
Busbar SS1	☑	☐
Busbar SS2	☑	☐
Busbar US	☑	☐
Affected feeder	☑*	☐
Adjacent feeder left	☑	☐
Adjacent feeder right	☑	☐

* via bus coupler & USB

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Gas Insulated Switchgear (GIS)

GIS Particularidades técnicas de la GIS

Operaciones en campo y pruebas AT

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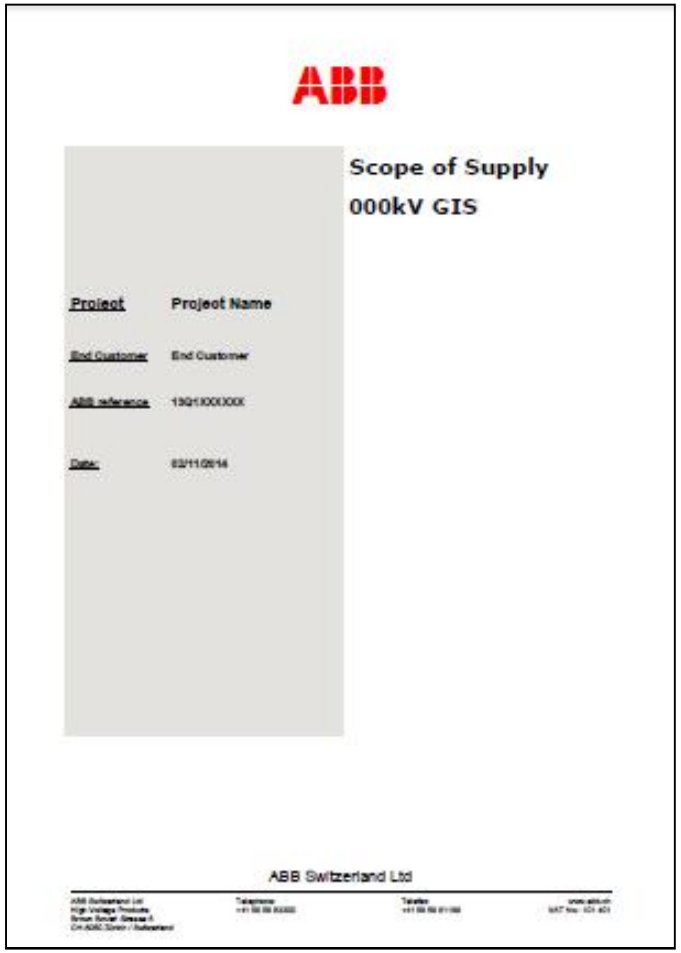
Operaciones en campo y pruebas AT
Fase de Oferta

Documentos específicos

- «Scope of supply»
  - Alcance de los equipos GIS
  - Supervisión de montaje
  - Personal requerido en sitio
  - Herramientas especiales que provee ABB
  - Infraestructura y herramientas que provee el usuario
  - Prueba de Alta Tensión



ABB

Scope of Supply
000kV GIS

Project Project Name

End Customer End Customer

ABB reference 1XX1XXXXXX

Date: 03/11/2014

ABB Switzerland Ltd

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Operaciones en campo y pruebas AT
Fase de Oferta

2.7 Services

2.7.1 Technical Advising of Installation and Commissioning

[1] Technical advising of installation and commissioning includes:
(1) Technical Advisor for Installation for a period of **00 weeks**
- including travelling and accommodation costs
- including special Tools and Devices (refer to 2.7.3)

(1) Commissioning Engineer for a period of **00 weeks**
- including travelling and accommodation costs
- including special Tools and Devices (refer to 2.7.3)

The indicated period is based on 5 working days a week and 8 hours a day. The time period stated is only applicable in case the work can be carried out in a continuous and most efficient manner.
If scope of supply includes cable connections or direct transformer bushing housings the installation of those is included during the main GIS installation period. Opening and closing of links for High-Voltage test purpose during installation period of GIS is also included.

Should the work have to be interrupted for reasons beyond our control or further trips from home base should be necessary (e.g. to perform connection work for cable connections or direct transformer bushing housings) then the waiting period or additional trips will be charged separately at actual costs and according to daily rate indicated under prices and terms of payments and the initially agreed commissioning end-date should be proportionally shifted.

Erection of the equipment is not part of ABB scope of supply. During installation and commissioning period the following local personnel has to be at the disposal of the ABB Technical Advisor:

(0) Foreman
(0) Engineer
(0) Skilled Fitters
(0) Skilled Electricians
(0) Helpers

The electricians, fitters and helpers have to be provided by the purchaser free of charge to ABB Switzerland

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Operaciones en campo y pruebas AT
Fase de Oferta

2.7.3 Special Tools and Devices provided by ABB for Installation & Commissioning

The following special tools and devices are necessary for installation of the GIS and will be provided by ABB Switzerland Ltd for temporary import only (Incoterms are DAP Site) for the duration of the installation. They will remain in ABB's property and shall be returned (allow exit from the site) by the purchaser, after performance of intended work. Freight back to ABB's works is paid by ABB, purchaser will bom applicable re-export paper work and costs according to local customs procedures.

A standard set of special tools provided by ABB Switzerland Ltd could look like:

(1)	Transit Level
(1)	Transportation Set (Incl. heavy lifting set, wheels, lifting slings)
(4)	Locking Pliers
(1)	Coupling Device
(2)	Guiding Pin Set
(2)	Puller 3/4 Tons
(1)	Puller 1.5 Tons
(1)	Tool-Car GIS
(1)	Torque Wrench 730R/20
(1)	Torque Wrench 730R/40
(1)	Socket Wrench 1/2 " 24 mm
(1)	Socket Wrench 1/2 " 30 mm
(1)	DILO Adapter 1 - 3 (3-224)
(3)	DILO Metal Hose NW 20 (Bellow Type)
(2)	DILO Extension Hose NW 20 (6 m)

(1)	DILO Extension Hose NW 8 (6 m)
(1)	Gas leakage detector
(1)	Pressure Gauge
(1)	Micro-ohmmeter
(1)	Diamond Head Drill with several Drills
(1)	Setting Tool for Anchor Bolts / High Friction Clamps
(1)	Vacuum Cleaner for GIS
(1)	Digital / Analogue Multimeter
(1)	Circuit Breaker / Disconnector and Earthing Switch Timing Analyser
(1)	CT and VT Test Equipment (optional according GIS Type)
(1)	Lettering / Labelling System

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Operaciones de campo y pruebas de AT
Fase de Oferta

2.7.5 High-Voltage Test on Site

[1] AC High-Voltage test on site during installation and commissioning period including:

(1) AC High-Voltage test on site, test procedure as per IEC 62271-203, §10.2.101.2.3, Procedure A.

(1) ABB test engineer for a period of **00 weeks.**
- including travelling and accommodation costs
- including special Tools and Devices (refer to 2.7.3)

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Field Operations & HV Test
Tendering Stage

Depending on the size of installation and availability of Equipment for Gas Handling purchased by Purchaser above list may vary and additional equipment will be provided.

Tools and Devices to be provided by Purchaser / Contractor

- Set of standard mechanical tools incl. set of socket wrenches
- Electrical drilling machine 18-32 mm, with drill stand
- Rotary Hammer Drilling machine (Type Hilti TE72 or similar)
- Electrical Grinders
- Welding transformer 150 amps
- Oxy-Acetylene Welding Outfit
- Work bench with vice
- Bending device for Copper or aluminium
- Lever punching machine for copper or aluminium
- Lettering / Labelling System
- Cable Reel (220 V and 380 V)
- Power distribution Board
- Cable Drum Jack and Cable Drum Shaft
- Cable cutter
- Electrical hand lamp
- Vacuum Cleaner
- Safety goggles
- Protective helmet
- Safety belt
- Medicine/First aid box
- Step-Ladders (several lengths, 8 - 12 steps)
- Scaffoldings for GIS installation

Infrastructure to be provided by Purchaser / Contractor

- Lockable Office with desk, chairs, shelf, lockable cupboard, fridge
- Phone and Fax access
- Material container / storage room with shelves for loose parts and tools
- Electrical power supply
- Fork Lift
- Mobile Crane for unloading of goods and outdoor-installation. ABB will provide the weight of the heaviest package prior to shipment. Purchaser/Contractor should evaluate the Crane size according to the site conditions.

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Field Operations & HV Test
Documentos Específicos

Documentos específicos del proyecto

- Manual de instalación y comisionamiento
- Prueba de Alta Tensión
- Instrucciones de servicio
- «Packing List» detallado
- Etc.

Ejecución de proyecto

- Cada documento tiene su código
- Lista completa para adecuado seguimiento

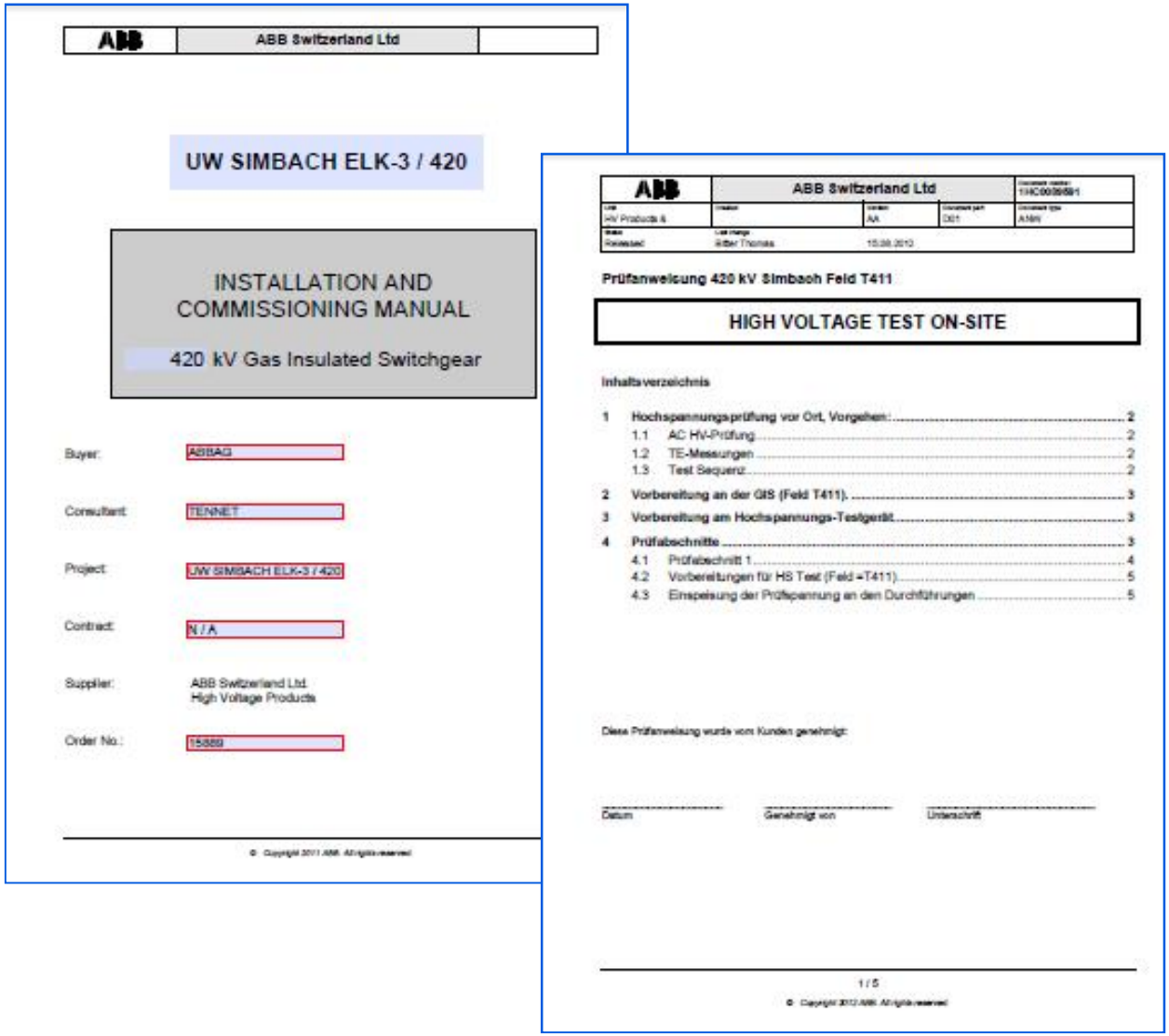
ABB Switzerland Ltd
UW SIMBACH ELK-3 / 420
INSTALLATION AND COMMISSIONING MANUAL
420 kV Gas Insulated Switchgear
Buyer: ABBAG
Consultant: TENNET
Project: UW SIMBACH ELK-3 / 420
Contract: N / A
Supplier: ABB Switzerland Ltd High Voltage Products
Order No.: 15869
ABB Switzerland Ltd
Prüfanweisung 420 kV Simbach Feld T411
HIGH VOLTAGE TEST ON-SITE
Inhaltsverzeichnis
1 Hochspannungsprüfung vor Ort, Vorgehen: 2
1.1 AC HV-Prüfung 2
1.2 TE-Messungen 2
1.3 Test Sequenz 2
2 Vorbereitung an der GIS (Feld T411). 3
3 Vorbereitung am Hochspannungs-Testgerät 3
4 Prüfabschnitte 3
4.1 Prüfabschnitt 1 4
4.2 Vorbereitungen für HS Test (Feld =T411) 5
4.3 Einspeisung der Prüfspannung an den Durchführungen 5
Diese Prüfanweisung wurde vom Kunden genehmigt:
Datum
Genehmigt von
Unterschrift
1 / 5

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Gas Insulated Switchgear (GIS)

GIS Portafolio de productos

Gas-insulated switchgear ELK-04, 145 - 170 kV

Sistema modular para GIS

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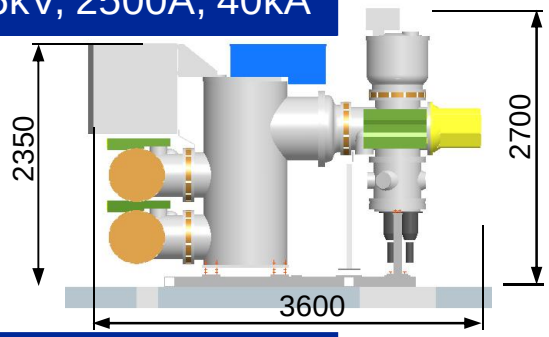
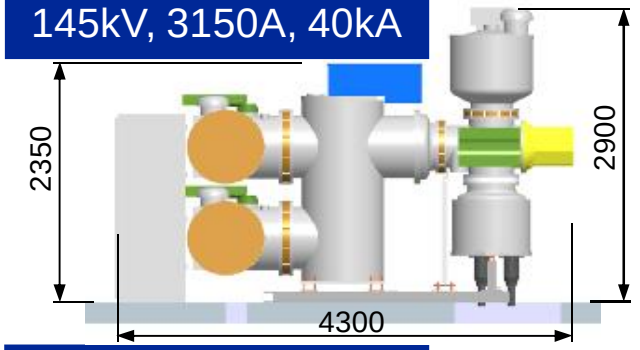
Portafolio Sub Transmisión
Diferentes layout (Double barra)

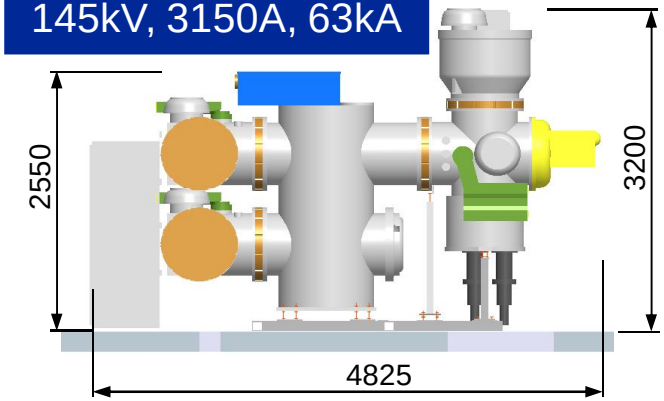
145kV, 2500A, 40kA



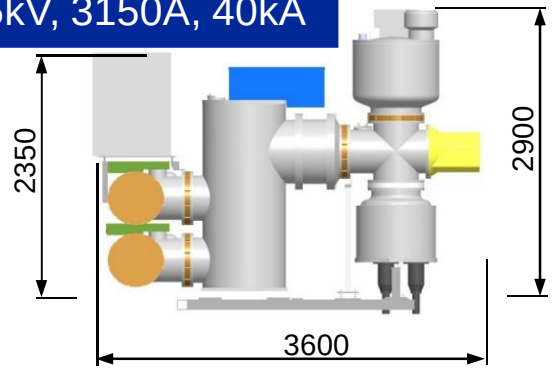
145kV, 3150A, 40kA



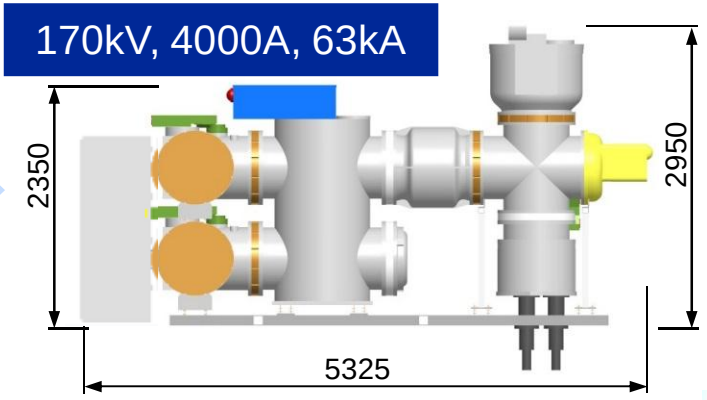
145kV, 3150A, 63kA



145kV, 3150A, 40kA



170kV, 4000A, 63kA



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Gas-insulated switchgear ELK-14, 245 - 362 kV

Sistema modular para GIS

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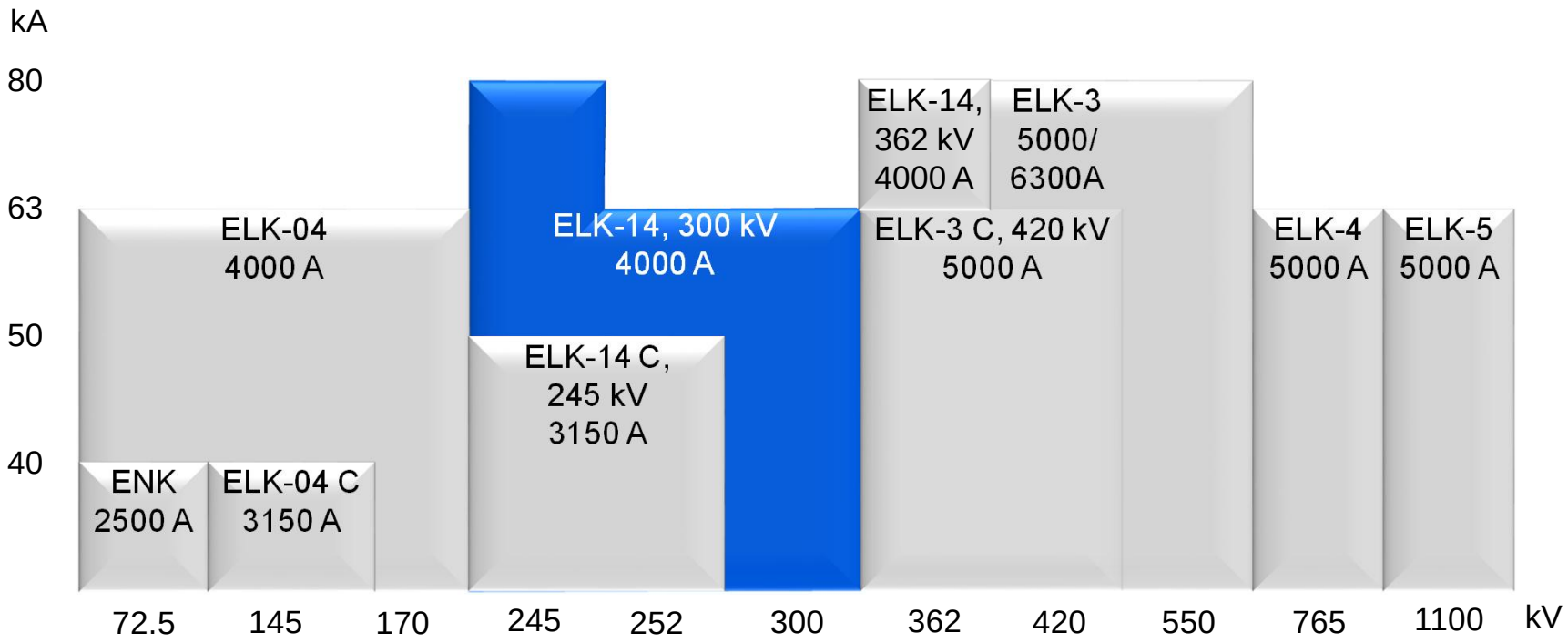
ABB

Gas-insulated switchgear
GIS Portafolio de productos y datos técnicos

ELK-14, 300 kV
duble busbar
arrangement

ELK-14, 362 kV
1½-breaker
arrangement



ELK-14, 245 - 362 kV
Diseño hasta 362 kV, 4000 A and 63/80 kA

ELK-14, 300 kV double busbar arrangement

ELK-14, 245 - 300 kV
Datos clave

Outdoor

Prueba sísmica hasta 1.0g

Data		Value
Rated voltage	up to	**300 kV**
Power-frequency withstand voltage		460 kV
Rated current		4000 A
Rated short-time withstand current		50/63 kA, 3 sec
Rated frequency		50 / 60 Hz
Lightning impulse withstand voltage		1050 kV
Rated peak withstand current		135 / 171 kA
Circuit-breaker mechanical endurance class		M2 (10,000 CO)
First pole-to-clear factor		1.3 / 1.5
Mechanical endurance (DS/ES)		10,000 CO
Bay length (incl. LCC; excl. operator's corridor)		5900 mm
Bay width		1680 mm

ELK-14, 362 kV
Key ratings

Diseño especial

Mercado americano 80kA y brasileño 345kV

Data	Value
Rated voltage	**362 kV**
Power-frequency withstand voltage	520 kV
Rated current	4000 A
Rated short-time withstand current	63/80 kA, 3 sec
Rated frequency	50 / 60 Hz
Lightning impulse withstand voltage	1175 kV
Rated peak withstand current	171 / 216 kA
Circuit-breaker mechanical endurance class	M2 (10,000 CO)
First pole-to-clear factor	1.3 / 1.5
Mechanical endurance (DS/ES)	10,000 CO
Bay length (incl. LCC; excl. operator's corridor) 63 / 80 kA	6800 / 7500 mm
Bay width 63 / 80 kA	2160 / 2700 mm

ELK-14 (hasta 300kV) & ELK-3 (550kV) Standards

ELK-14 & ELK-3 conforms to the latest set of IEC and IEEE standards

- **IEC 62271-203**
  Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV
- **IEC 62271-100**
  High-voltage alternating current circuit-breakers
- **IEC 62271-102**
  High-voltage alternating current disconnectors and earthing switches
- **IEC 62271-209**
  Cable connections for gas-insulated metal-enclosed switchgear for rated voltages above 52 kV
- **IEC 62271-1**
  Common specifications for high-voltage switchgear and controlgear
- and other related standards

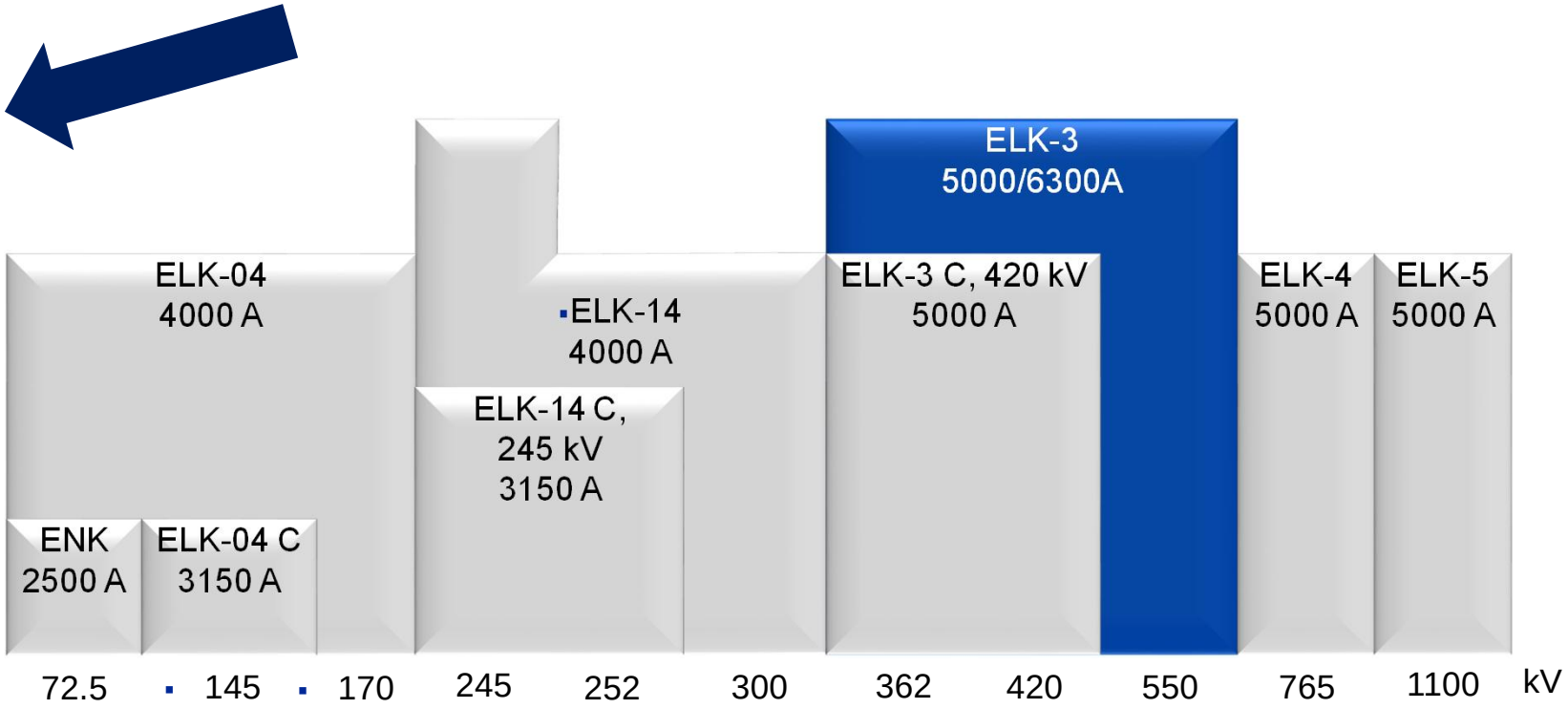
- **IEEE Std C37-122**
  IEEE Standard for High Voltage Gas-Insulated Substations Rated above 52 kV
- **IEEE Std C37.04, IEEE Std C37.06 IEEE Std C37.09, IEEE Std C37.010 IEEE Std C37.011, IEEE Std C37.012 and IEEE Std C37.015**
- **IEEE Std C37-122**
  IEEE Standard for High Voltage Gas-Insulated Substations Rated Above 52 kV
- **IEEE Std 1300**
  IEEE Guide for Cable Connections for Gas-Insulated Equipment
- **IEEE Std C37-100.1**
  IEEE Standard of Common Requirements for High Voltage Power Switchgear Rated Above 1000 V
- and other related standards

Gas-insulated switchgear ELK-3, 550 kV
GIS for maximum performance

Power and productivity
for a better world™

Gas-insulated switchgear
GIS Portafolio de porductos y datos técnicos

ELK-3, 550 kV



Test Duty	TRV Value	Rate of rise
TD10 (4kA)	1'500kV	2kV/µs
TD30 (12kA)	1'567kV	2kV/µs
TD60 (24kA)	1'058kV	2kV/µs

ELK-3, 550 kV
Datos clave

Outdoor

Data	Value
Rated voltage	550 kV
Power-frequency withstand voltage	740 kV
Rated current (busbar / feeders)	6300 / 5000 A
Rated short-time withstand current	63 / 80 kA, 3 sec
Rated frequency	50 / 60 Hz
Lightning impulse withstand voltage	1675 kV
Switching impulse withstand voltage	1250 kV
Rated peak withstand current	171 / 216 kA
Circuit-breaker mechanical endurance class	M2 (10,000 CO)
First pole-to-clear factor	1.3 / 1.5
Mechanical endurance (DS/ES)	5000 CO
Bay width	2700 mm

Encantado de atender sus preguntas!

Muchas gracias por su atención !

Power and productivity
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Ruben González
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